THE TRADE REVIEW

AND WESTERN MACHINIST.

WEEKLY EDITION, Vol. XVI—No. 19. | CLEVELAND, MAY 12, 1883. | MONTHLY EDITION Vol. I.—No. 5.

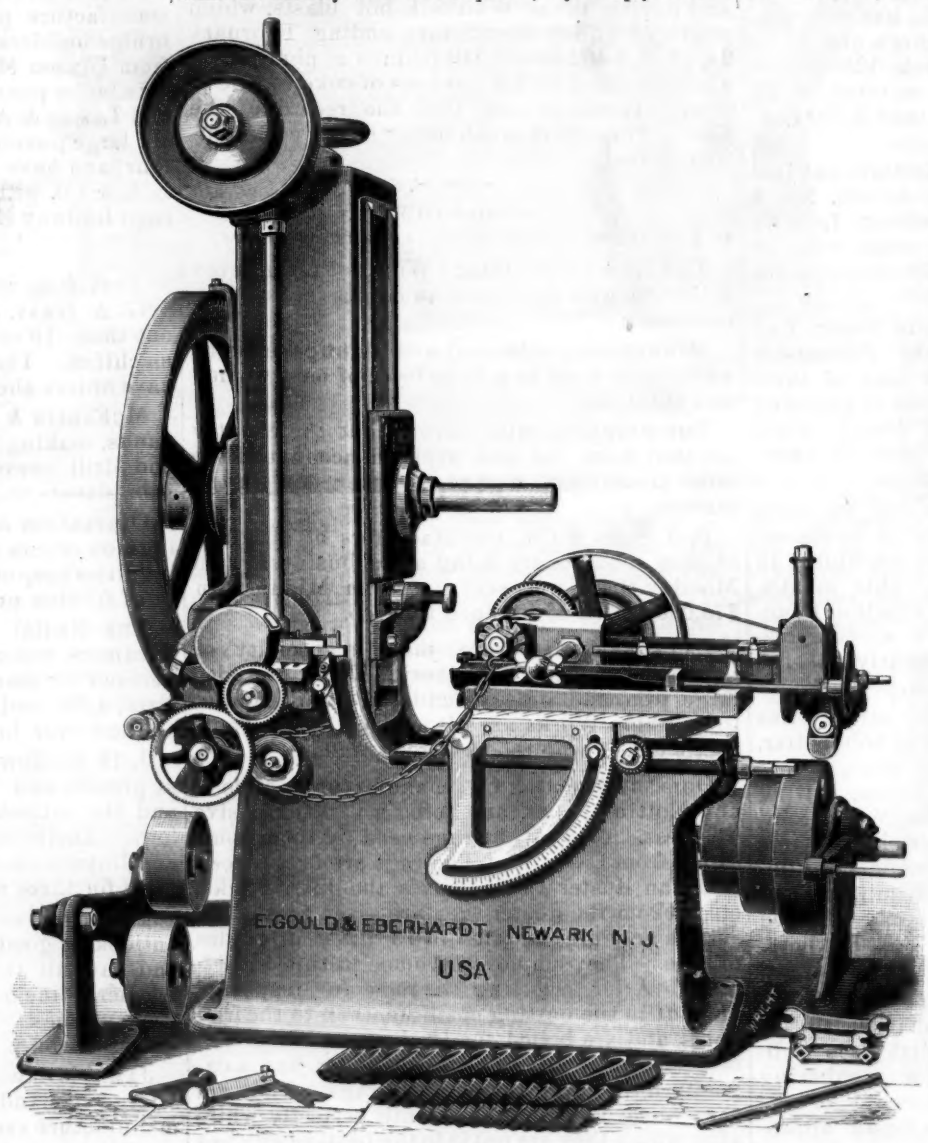
New Machinery.

Universal Automatic Gear Cutter.

The advisability of using accurately-cut gears for transmitting power, in many instances where cast gears have formerly been considered "good enough," if not satisfactory, has stimulated improvement in machines for cutting gears, not only accurately, but cheaply. A large part of the expense of gear cutting is the wages of a skilled attendant, whose time is, in the operation as ordinarilly performed, constantly occupied in the work of cutting. In order to cheapen the process of gear-cutting by rendering this constant attendance unnecessary, various machines, more or less automatic in their operation, have been from time to time introduced, and have met with considerable favor where much of the class of work on which they can be employed is done. It is evident that, in order to realize the full advantages of automatic operation, the machine must perform all the operations necessary to the cutting a gear wheel, as when it does this it substantially dispenses with hand labor, so far as the cutting is concerned.

The engraving herewith presented represents a new universal automatic gear-cutting machine, the term "universal automatic" being used in the sense that literally all the motions necessary to completely finish the cutting of the wheel, after the machine is started, are performed by the operations of the machine itself, whether on spur, bevel or worm gearing.

This machine represents several years' study of the subject of automatic machinery in connection with the processes of gear cutting, with the object of producing one that should be quite automatic in its character, positive and correct in its motion, and at the same time simple and comparatively cheap in its construction; in other words, a machine with which it would be possible to produce accurately-cut gearing at a little advance in cost over cast gearing.



UNIVERSAL AUTOMATIC GEAR CUTTER.

It will be seen from the engraving that the operating mechanism is mounted on a rectangular frame of suitable height, with a projecting vertical arm, the whole being of a form best adapted to the purpose of receiving the necessary parts. The wheel to be cut is adjusted on a mandrel projecting from the slide, as shown. This slide is guided on V's, and is adjusted vertically to the size of the wheel, and to the exact depth of tooth to be cut, by means of the hand-wheel shown on top of the machine, the adjusting arrangement registering to the the thousandth of an inch. When thus adjusted, and the machine set for the proper divisions, the cutter is fed through, there being twelve changes of feed to accommodate different materials being operated upon. The cutter is then returned, the return motion being being thirty-two times as rapid as the forward or feed motion. After one tooth is cut, the motion of the machine withdraws a stop, when the upright shaft shown at the side of the machine operates to revolve the wheel to the next space to be cut, the arrangement being such that the division cannot be incorrectly made, when it is locked for the next cutting movement of the cutter. These motions are automatically repeated without danger of mistake until the cutting is completed, which is signalled by the striking of a gong, thus warning whoever has it in charge to place another wheel for cutting.

The necessary motion of the upright shaft is made by means of a belt on the friction pulley shown near the top of the machine, which is driven by a small pulley on the countershaft. This friction pulley turns loose on the shaft at such times as the stop prevents the upright shaft from turning, the friction being sufficient to turn the shaft is withdrawn. The rim support, shown under the mandrel, can be readily adjusted to any position, or removed entirely when not required, by simply loosening two bolts. Its use is a great convenience in cutting large weeels, enabling the cutting to be done faster and surer than without its use.

In cutting bevel or miter wheels, the adiustment of the cutter slide is made by means of the worm wheel and graduated quadrant shown, to thousandths of an inch; in fact, the setting of cutters and setting over for worm or bevel wheels, etc., are all done to accurate graduations, enabling these operations not only to be performed with great accuracy, but with dispatch.

The rim of the dividing worm wheel is made in two sections firmly bolted together, so that by loosening the two sections and shifting their relative positions, after it is cut, its accuracy can be readily tested. In use, the worm can be withdrawn from the dividing wheel when it is desirable to test large wheels before cutting.

In cutting wheels with a machine of this character, where the cutting is going on without the presence of an operator, the accumulation of chips is found to be a serious inconvenience, often injuring the bearings and other parts of the machine. To avoid this in this machine, an ingenious device is employed, which removes the chips as fast as made, depositing them inside the hollow base, where they can be taken out when cleaning shop, or at any other convenient time.

The machine is of a construction to be readily comprehended, and requires no special skill to adjust. It is strong in its general character, with ample bearing and wearing surfaces and strongly geared, the intention being that the speed of cutting shall be gauged only by the ability of the cutters to stand the work. Wrought iron work subject to wear is case-hardened, and the necessary wrenches, &c., furnished.

These machines are made in any desired sizes by E. Gould & Eberhardt, Newark, N. J.

RAILWAY EXPOSITION.

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Positively No Postponement—Further Facts.

We make room for the following important announcement by Secretary Talbott, just at hand: "The management take this means to correct certain erroneous statements relative to the date of the opening of the National Exposition of Railway Appliances, inadvertently circulated by various newspapers. There will be no postponement of the date originally fixed, viz: May 24th. Exhibits are already arriving in large numbers, and the management have no other idea than that everything will be in place and in readiness for the inaugural ceremonies at noon of that day. Exhibitors are urgently requested to hurry the shipment of exhibits and cause them to be put in position with the least possible delay, marking their names upon them in every case."

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EXPOSITION NOTES.

The most remarkable collection of locomotives, ancient and modern, ever brought together will be on exhibition.

The Governor of Georgia and staff will visit the Exposition in June.

A more recent addition will be complete apparatus for exhibiting safety signal devices.

The collection of iron and other ores, by Mr. A. P. Swineford, will make several carloads.

The electric railway is in rapid preparation.

Many carloads of entries have already been received.

Seventeen cases of exhibits are now in transit across the ocean.

Living game fish will be contributed by Northwestern Railroads.

The English Commissioner, Mr. G. D. Peters, of London, is now en route.

Large exhibits of luxuriant sub-tropical vegetation will be contributed by Southern railways.

The electric storage battery and the incandescent light will be there. Colored electric lighting will be introduced about the fountain.

The entertainment of visitors is being systematically provided for. Rooms will be opened at a central point for registry and information as to hotels, boarding houses, etc.

Manufactures.

OHIO INDUSTRIES.

CLEVELAND.

THE Otis Iron & Steel Co., of this city, have lately appointed J. T. Ryerson & Son their Chicago agents.

WESTERN sewer pipe manufacturers met in this city the past week and discussed the business situation in secret session.

A conference of bolt manufacturers of the United States was held in the Kennard House parlors Wednesday with closed doors.

THE molders in the employ of Peck, Stowe, Wilcox & Co., on Central Way, 52 in all, have struck for an increase of 25 cents per day.

THE Consolidated Vapor Stove Co. of Cleveland, capital stock $300,000, in shares of $100 each, by W. M. Lottridge, G. E. Herrick, C. B. Bernhard, W. C. North, and M. L. Hull, has been incorporated the past week.

MR. A. J. RICKS, as special master, has been engaged the past week in the case of Bernard Louth against the Cleveland Rolling Mill Company, on reference as to damages sustained for the use of the "Louth three high roll" for rolling steel plate.

THE City Council at Elgin, Ill., has contracted to erect seven tubular iron towers, one to be 150 feet high, and six to be each 125 feet in height, and to place upon them a total of 23 Brush electric lamps of not less than 2,000 candle-power each.

THE largest leather belt in the State has just been furnished by Bodifield & Arnett, No. 8 South Water street, for the Sturtevant Lumber Co. It is 109 feet in length, 30 inches wide, of double thickness, and required 50 whole hides to make it. The cost was $600.

CAPT. GREENHALGH, of the White Stack Tug Line, has placed an order with the Pulsometer Steam Pump Co., New York, for one of their largest pulsometers for the purpose of pumping sand. In about five weeks Mr. Frank Gray, representing this company, will give an exhibition, on the river, of the pulsometer.

THE Republic Iron Co., of this city, we learn from the Ishpeming Iron Agitator, is endeavoring to have the new engine-house machinery in working place by the first part of this month, though it will require continued exertion to accomplish the task. The two new air-compressors are now doing duty, and nearly all the drills in the mine are in operation.

JAMES AITCHISON, 50 52 Canal street, has lately brought out a new automatic bolt cutter, patented March 20, 1883, by Ira Culver, of this city. It is of very simple construction, cutting from one fourth to four-inch bolts. Mr. Aitchison has just completed one of these bolt-cutters for use in his shop and has also made for himself several new tools, including a milling machine, gear cutter, etc. He has lately shipped to the G. B. Hall Manufacturing Co., Roxboro, Vt., a turret lathe, and has also sent out several small lathes.

THE TRADE REVIEW has information that a manufacturer and patentee of a first-class boiler pump and heater combined, in a neighboring city, contemplates moving on account of the ground on which his shop stands being appropriated for other purposes. He would like to come to Cleveland if the proper inducements, including a small amount of capital, are forthcoming. If any TRADE REVIEW readers want to look further into the matter, the name and address of the gentleman will be given on application.

AT a recent meeting of the creditors of the Cleveland Bridge & Car Works, 61 per cent. of the amount of indebtedness being represented, a resolution was passed that the assignees be requested within the next 60 days to sell the property of the company, both real or personal, except book accounts and bills receivable when enough can be realized by such sales and by the collections of accounts and bills receivable to pay the creditors 50 per cent. or more, exclusive of interest, on their claims, and that the Probate Judge be requested to confirm a sale or sale which will pay the claims as above stipulated.

THE American Wire Co., of this city, recently issued a circular to the trade, in which they say: "We need only to refer you to the names of the officers of this company as a sufficient guarantee that the quality of our production will be of the very highest standard. Having secured the services of men of long practical experience, selecting them with especial references to their known ability and perfect knowledge of the wire business in its every detail in their several departments, we start our business and works with the full benefit of years of thorough training and practical experience, added to the latest and best improved machinery and patented appliances, with unexcelled facilities in buildings and location for manufacturing all descriptions of wire at minimum cost to produce best results."

THE Emma Furnace of the Newburg Furnace Co., in the Eighteenth Ward, made a remarkable run for the week ending April 29. During that time it turned out 764 tons of pig iron of 2,300 pounds to the ton, on 2,304 pounds of fuel per ton, of which 2,016 were coke and 288 pounds were Palmyra coal. The size of the furnace is 15½x75. Mr. G. D. Wick is the efficient manager. This run is all the more remarkable since much ado has been made over the Isabella Furnace, of Pittsburgh, 20x75, and having three Whitwell hot blasts, which produced during the 32 days ending February 24, 1882, 5,402 tons 1,240 pounds of pig iron, on a consumption of 1 8-100 tons of coke to one of iron. It will be seen that the record of the Emma Furnace is much better as to consumption of fuel.

MIDDLETOWN.

BY A TRAVELING CORRESPONDENT OF THE TRADE REVIEW.

THE Middletown Buggy Works of Lueg Levoy & Co. report a good trade and orders constantly increasing.

MIDDLETOWN is blessed with eight paper mills which give work to a large force of men, women and children.

THE wrapping mills throughout the country are shut down for one week on account of the large quantity of wrapping paper now in the market.

P. J. SORG & Co., manufacturers of all kinds of plug tobacco, are doing a big business. On Monday there was sent out from Middletown $75,000 worth of stamped tobacco.

LA TOURBRETTE & Co. make a specialty of paper and tobacco machinery. They are also large iron and brass founders. The Middletown Pump Works are also owned by La Tourbrette & Co., who report a good trade.

OGLESBY MOORE & Co, manufacturers of book and blotting paper, are doing a very extensive business. Most of the rags used by them come direct from Calcutta. The rags are first placed in a fan duster that removes the dust, sticks, etc. From the duster they are given to the assorters and are assorted in 13 different grades of rags. They employ 15 women in this department. After assorting the rags are inspected and put in the cutting machine, then to the iron boiler and are boiled for 12 hours so they will be perfectly clean. This large boiler has a capacity for holding three tons of rags. They are then washed and bleached until perfectly white after which they are put into the beating engines and are beaten to a fine pulp. Then the pulp is sent to the stuff chest, thence pumped to the paper machine; then it is sent through the steam heat rollers and finally comes out a quality of fine white book paper.

HAMILTON.

BY A TRAVELING CORRESPONDENT OF THE TRADE REVIEW.

SOHN & RENTSCHLER are running over-time 12½ hours, are behind on orders and will increase their force from 60 to 70 men.

THE large distillery of Pattison, Caldwell & Co. burned down a short time ago, will not be rebuilt. They are at present adjusting the insurance.

BUNTEL, MARGEDANT & Co. manufacture a general line of wood-working machinery, and are employing 80 hands. They find the prospect for work good, although the spring was a little backward.

RITCHIE & DYER Co. manufacture saw mill and traction engines, steam plows, road engines, saw gummers, etc. They report an excellent trade and rapidly increasing. They are now running over-time.

HOOVEN, OWENS, RENTSCHLER & Co. are full of work, having lately commenced the manufacture of the Corliss engine. They have orders for several of these large engines, from the Vandalia Paper Co. Vandalia, Ill., Franklin and Hamilton paper mills also.

THE BLACK & CLAWSON Co. are employing 50 hands and are working 12 hours a day. They make a specialty in paper mill machinery. They have orders for 60 days in advance. They are now building a large foundry and carpenter shop: Foundry 105x40, carpenter shop 40x40. They have orders from the Plain City Paper Co., Plain City, O., and are making to order a machine for the manufacture of car roofing for the Wolverine Car Roofing Manufacturing Co., Detroit, Mich., also for the Vandalia Paper Mill Co., Vandalia, Ill.

LONG, ALLISTTER & Co. are running full time and making a great deal of heavy machinery. They give employment to 175 hands and are turning out a general line of agricultural implements such as cultivators, rakes, plows, sulkies, barn tools etc. In their tool department they manufacture punches, shearing, railway and bridge builders' machinery. They have orders from Dixson Manufacturing Co., Scranton, Pa., for a boiler punch machine, weight 20,000 pounds and Lassig & Alden, Chicago, bridge works for six large punches. They have already shipped four and have two more nearly ready to go. L. A. & Co. will have a large display at the Chicago Railway Exposition.

CINCINNATI.

BY A TRAVELING CORRESPONDENT OF THE TRADE REVIEW.

G. A. GRAY, JR., & Co. are very busy turning out their 19 inch lathes and 26-inch planing machines. They are employing 25 men and have orders ahead for four months.

MCFARLIN & NOTTINGHAM are employing 25 hands, making their well-known lathes, planers and drill presses. They make a specialty of iron planers and friction clutches.

OESTERLEIN & BERNHARDT are very busy, having now orders for three months ahead and still inquiries keep coming in. They make a specialty of friction pulleys and machinists' tools.

THE Radial Drill Co., corner Eighth and Sycamore, report a good trade and find a ready demand for machines. They are making two sizes, 4,500 and 6,500 pounds respectively, and are now over four weeks behind on orders.

J. H. MCGOWAN & Co. say they are very busy at present and have all they can possibly do; and the outlook is fair but prices are a little low. Their specialties are tobacco, pump and linseed oil machines. They have orders on hand for three months yet.

T. J. NOTTINGHAM & Co. report the business outlook as good. They are employing 100 hands and have all they can do. They manufacture a general line of brass, manufacturing and railway supplies. They are also handling largely wrought iron pipe and fittings.

JAMES MURDOCK, JR., reports a good trade and a large demand in their line of goods. They manufacture every variety of plain and fancy moulds and stamps, seal presses, baggage checks, wax seals, etc. They employ 40 hands and have to run over time to keep up with orders.

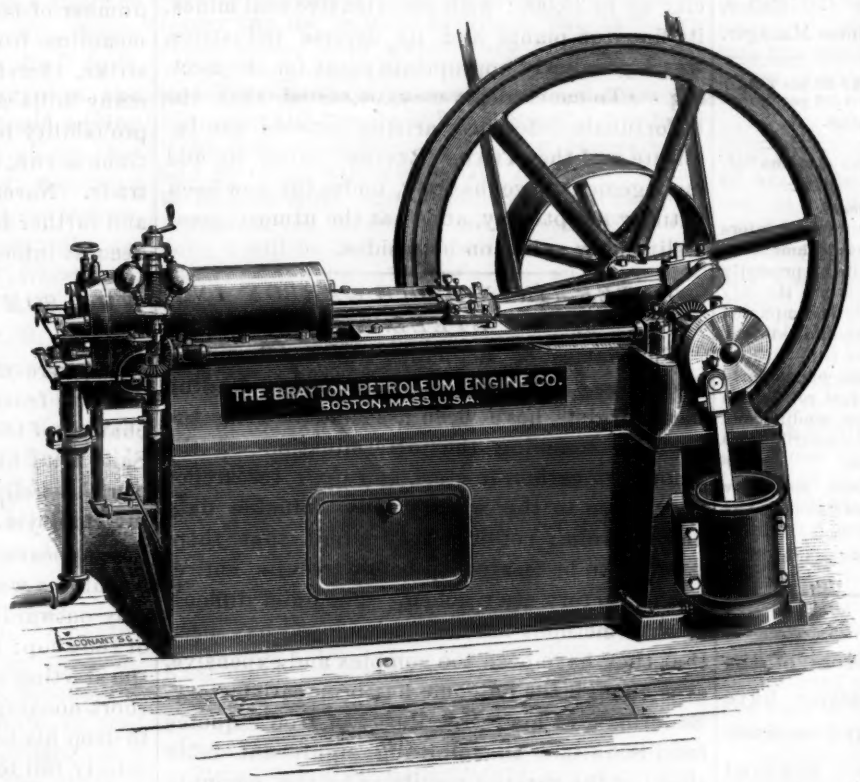
MESSRS J. Steptoe & Co., of 214 West Second Street, report business good. They are making a specialty of 15-inch shapers and have now orders ahead for 90 days. They also make lathes and planers and all kinds of machinists' tools. They will have a large display at the Chicago Railway Exposition, and will be represented by Fay & Co.

LODGE, BARKER & Co., of 189 & 191 West Pearl street, are very busy and have all they can possibly do. They are now behind on orders and also have orders ahead for three months to come. Have orders from the State of Texas for their large size lathes, San Francisco and other points. They also send to Dayton next week 14 lathes which are nearly finished. They will ship 20 lathes this week. Their specialties are turret and engine lathes.

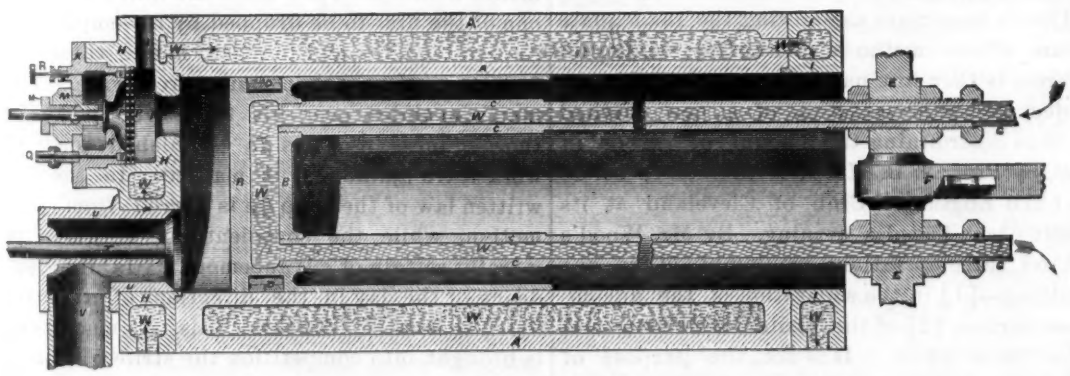
Useful Inventions.

Petroleum as a Motive Power.

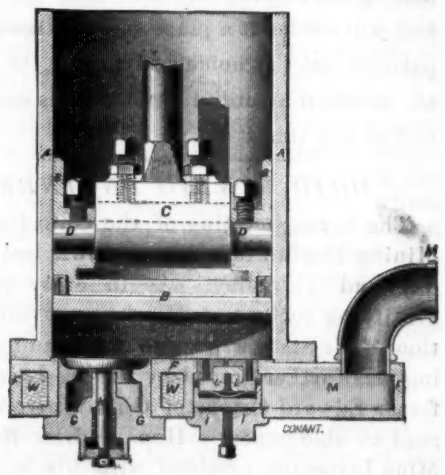
An engine that is started instantly into full operation by the application of a lighted match and stopped by the closing of a valve; that has no boiler, fire-box, nor other highly heated parts, is absolutely safe from fire or explosion; that will not enhance the cost of insurance in a building; that creates neither sparks nor cinders and generates no dust; that requires no brick nor masonry; that occupies small space and costs nothing when not in use, and that can be run ten hours at five horse-power, at a cost of 60 to 80 cents, surely presents some claims to public attention as startling as they are novel. When it is added that the fuel is crude petroleum, the general interest in the subject demands more explicit information. Such information we herewith present, by the aid of well drawn diagrams. The leading illustration presents the Brayton Petroleum Engine in readiness for work. The vertical sectional views show the jacketed cylinder (AA), fire and water heads (HH and II), elongated piston (BB), piston rods (CC,) and cross head (E), together with the air compressor. The oil engine bears a close resemblance to the steam engine, its operation being precisely similar in the action of the engine proper, and in the distribution of pressure in its cylinder, to that of the steam engine. While the action of the impelling fluid is not explosive, as in every other form of gas engine. The air compressor, which supplies the reservoir within the base with atmospheric air, compressed to any required density from 60 to 100 lbs. to square inch, consists of cylinder (AA), piston (B), connecting rod (C), and packing rings (EE). In the air compressor head (FF) are the induction valve (H) and the eduction valve (I), both acting automatically as the piston (B) rises and falls in cylinder. The air compressed passes through port (M) to reservoir. The jacketed working cylinder (AA) is twice the length of the stroke, and the elongated piston (BB) the same length as stroke of engine. Packing rings (DD) of cast iron, accurately fitted, and the cylinder, are kept constantly lubricated by the condensed product of combustion. This condensation is effected by the distribution of the water circulation (represented in cut by letters WW) into elongated piston (BB), through hollow rod (C), and thence by hollow rod (C) into fire head (H), thence into water jacket (AA), and then through water head (II) to waste. In the fire head (HH) is a vacant space termed the combustion chamber (N), in which a constant flame is maintained to avoid the necessity of igniting the vapor at every stroke. There is an opening (O) into this chamber, through which the vapor is first ignited, which is then closed by a valve called the fire-stop. In the outer part of the combustion chamber (N) is a pervious partition (P P), through which the mixed compound of air and petroleum has to pass before it can burn. This partition consists of three or four diaphragms of fine wire gauze, that are held between two perforated plates of metal for protection. Just below these plates is a circular groove or annulus, packed with cotton braid, called an evaporator (S), into which the oil is injected by oil pump. A small jet of air is also introduced into this cavity, which performs two offices; the first, to convert the oil into spray; the second, to supply sufficient oxygen to maintain the continuous flame (the smaller the jet of air the greater the saving). The oil spray that is thrown up by the air jet is held in the meshes, or wire gauze forming the partition, so that when the main air pressure is admitted by opening the induction valve (L), it is forced through by the air current into the combustion chamber (N), complete combustion being secured by thorough mixture with sufficient oxygen The heat at this point being excessive, the gases expand to about six volumes. But as the gases burn while entering the cylinder (communication being open between the air reservoir and cylinder), there can be no direct increase of pressure in the cylinder in consequence of ignition, but the effect is to hold back several volumes in the air reservoir that would have escaped had the gases not been ignited. and by means of a moderate sized air compressor a uniform maximum pressure is maintained in the air reservoir. In the use of petroleum there will be a deposit in the gauze diaphragms that will, in six days running, obstruct the free passage of air into the combustion chamber. These can be easily taken out, cleaned, and replaced in a few minutes, as can also the exhaust bonnet (U) whenever the exhaust valve (T) may need cleaning. The best method of cleaning the wire gauzes is to hold them individvally in the flame of a spirit or kerosene lamp until the deposit is burnt to an ash, then remove the ash by using a stiff brush. The cotton braid used in the evaporator should be renewed whenever the ends, which are butted together over the air vent passage (B), are wasted or destroyed. These are the only points needing attention, aside from the adjustment due to the natural wear of the engine, and lubrication of all journals and bearings. The prices quoted are: $625 for 5 H. P. engine and $475 for 3 H. P. The Brayton Petroleum Engine Co., 50 Federal street, Boston, Mass., will answer all inquiries.



THE BRAYTON PETROLEUM ENGINE.



VERTICAL SECTION OF JACKETED CYLINDER AND FIRE HEAD.



VERTICAL SECTION OF AIR-COMPRESSOR.

The Viscosity of Lubricating Oils.

The Oil, Paint & Drug Reporter, in the course of an article on the above subject says: In the course of some recent experiments to determine the value of several oils under varying conditions of speed, temperature and pressure, it transpires that the value of a lubricating oil varies wonderfully with the temperature of the bearing where it is applied, which of course is governed by the speed of the bearing and the lubricator. An oil that answers excellently on the bearings of heavy mill gear will take fire, or stop a quick-running spindle. While a good spindle oil at ordinary temperature would squeeze out of a heavy bearing and require to be supplied to the box in a steady stream to prevent heating by friction, yet in sufficiently cold weather a spindle oil that thickened sufficiently to have a high viscosity, but did not actually "chill up," would probably answer very well. It is found that while in the power and amount of oil consumed there may be little choice in several heavy petroleums on a bearing at 60 deg. F., at 200 deg. some become comparatively worthless, and the power required to run the shaft was, in case of some oils, double that required in others; and, strange to say, some oils supplied in limited quantity at this temperature bore the strain of twice the power without allowing an increase of heat in the bearing, while another similar appearing oil would not retain the heat at 200 deg. when supplied in large excess. One reason of these differences is that when the temperature reached 200 deg. some of the oils became so thin as not to remain between the bearing surfaces, and were thus useless. It was also found that an exceedingly small amount of oil only is actually consumed by even a large bearing, where no excess is supplied, and there is no way for good oil to run to waste. It is then found that the limit of efficiency is only where the oil becomes so charged with floating particles of metal, worn from the box and bearing, that it will no longer reduce friction sufficiently to keep down the heat of the journal. It is also noted that many thick oils that are excellent lubricants, have a certain friction of their own, and thus when applied to a journal under heavy pressure will heat up to perhaps 125-140 deg., as readily as an oil deficient in lubricating quality; but at that temperature they lubricate so well as to prevent a further increase of heat, while a thinner oil, of less lubricating value, would keep the same journal entirely cool if applied when the temperature was down. These facts go to show that no special oil can be expected to answer a diversity of purposes, and that viscosity, like all other qualities of lubricants is of only relative value.

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SIXTEENTH YEAR.

Devoted to the Manufacturing, Scientific, and Industrial Interests of the Country.

PUBLISHED EVERY SATURDAY.

Office—Corner St. Clair and Ontario Streets,
CLEVELAND, OHIO.
TELEPHONE NUMBER, 1,916.

WILSON M. DAY, - - - - - - Editor.
FRANK N. CARTER, - - Business Manager.

SUBSCRIPTION, (POSTAGE INCLUDED), { Weekly $3.00 per Year. Monthly 1.00 per Year.

☞ Advertisng Rates Furnished on Application.

Entered at the Post Office at Cleveland as second-class matter.

To Machinists, Manufacturers and Others.

THE publishers of the TRADE REVIEW solicit items of information concerning manufacturing and other establishments in any part of the country, and all such items will be promptly inserted in these columns, free of charge. Facts are the only things needed; and all communications should be accompanied with the name of the contributor—not for publication—but as a guarantee of good faith.

Manufacturers, machinists and engineers are particularly requested to communicate any matters of interest relating to their specialties. No one need be deterred from sending any interesting facts in his own language, as all such contributions will be properly revised before sending to press.

☞ When writing to any of our advertisers, please sav that you saw their advertisement in the Cleveland TRADE REVIEW.

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INTO NEW OFFICES.

For some time past the proprietors of the TRADE REVIEW AND WESTERN MACHINIST have felt the need of more commodious and accessible offices, and to this end they have engaged and will next week occupy new and attractive quarters in the Board of Trade building, No. 122 Water street, Rooms 30 and 31. This change will place the TRADE REVIEW right among the leading business men of Cleveland and will render it a place of easy resort for its patrons, both at home and abroad, to one and all of whom a cordial invitation is extended to call at any time.

OHIO MINING ENGINEERS.

The Spring meeting of the Ohio Institute of Mining Engineers at Youngstown, last Wednesday and Thursday, was in every respect a gratifying success. Nearly every mining section of the State was represented, and the meeting was further graced by the presence of Professor Edward Orton, of Ohio University, who read an able paper. Hon. Andrew Roy, State Mine Inspector, presided with his accustomed affability and Mr. R. S. Paul, of Akron, most satisfactorily filled the duties of Secretary. The regular sessions took place in the evening at Excelsior Hall, and the day-time was passed in the inspection of the various mines and iron works concentrated about the metropolis of the Mahoning Valley. The editor of the TRADE REVIEW on Wednesday had the pleasure of accompanying the engineers on an underground inspecting tour of the shaft and workings of the Leadville Coal Co., a short distance from the city, under the pilotage of Mr. R. M. Hazeltine, to whom much of the credit is due for the completeness of all the arrangements. The Leadville shaft is about 175 feet deep and extends underground in the zigzag course peculiar to the mines of this valley. The vein varies in thickness, we should say, from 2 to 4½ feet. The roof is generally in excellent condition. The air is plentiful and good. A great deal of water has to be taken care of, but engineering skill has successfully met the problem. A fine vein of blackband ore is being worked in one section of the mine. On Thursday the Church Hill mines were inspected with equal pleasure. The various papers read and discussions following were listened to with much interest and profit. No more intelligent and progressive body of men can be found in Ohio than her mining engineers. Youngstown, with an incorporated population of 21,000 and a population immediately contiguous sufficient to swell the census of the city up to 35,000; with its extensive coal mines, its fine iron plants and its diverse industries, was a peculiarly appropriate point for the meeting. To conclude, it may be stated that the unfortunate differences arising between the Institute and the TRADE REVIEW under its old management have, happily, under the new been entirely swept away, and that the utmost good feeling now exists on both sides.

DETERMINING THE CARBON IN STEEL.

The names of Regnault, Ullgren, Berzelius, Fresenius, Boussingault and other leading metallurgists have been associated with the problem touching the determination of the amount of carbon in steel, and their researches have given to the world many valuable data and formulæ; yet even they admit that there is much to be cleared up before results entirely satisfactory are reached. The chief difficulty with methods heretofore employed has been that they have been too complex and expensive, even though the outcome has been satisfactory. Bauerman, in his "Metallurgy of Iron" quotes from Schnitzler the following significant table showing the varying results as to the amounts of carbon in the same steel given by the different methods:

	I	II.	III.	IV.	V.	VI.	VII.
Combined carbon, per cent....	—	—	—	—	—	0.09	0.18
Graphitic " " " ...	—	—	—	—	—	0.78	0.74
Total.....	0.74	0.75	0.68	0.93	0.96	0.92	0.92

Nos. I., II., III. Determinations by Weyl's method. Nos. IV., V. By Berzelius's method with chloride of copper. Nos. VI., VII. By Fresenius's method of determining the combined carbon directly. The latter is not applicable to such irons as contain a large amount of combined carbon, such as spiegeleisen, which, when dissolved in acid, deposit hydrocarbon oils that are not carried off by the hydrogen evolved.

This is important as showing the inadequate nature of the methods heretofore employed. Interest is therefore naturally reawakened in the subject by the presentation of a new method for thus determining the amount of carbon in steel, by Prof. N. B. Wood, of this city, before the Civil Engineers' Club of Cleveland at its meeting last Tuesday evening. By Mr. Wood's method, three operations are combined in one resulting—[1] in the separation of the uncombined carbon, [2] of the combined carbon, and [3] of the sulphur. It is not the purpose of this article to enter into the details of the new method but simply to introduce the subject as preliminary to the publication of the paper itself in our next issue, accompanied with a diagram fully explaining the mode of operation. We invite for it a careful perusal.

THE LABOR OUTLOOK.

Of course on all hands attention is drawn to the progress of the great strike already inaugurated among Pittsburgh miners and the impending one on the part of the Amalgamated Association of Iron and Steel Workers also affecting that city. If reports are to be credited, the miners' strike, though a general one to start with, has been broken to some extent by the return of about 1,000 men to work at the reduced price, 3 cents per bushel. On the other hand it is stated that two or three mines are working at the advance, 3½ cents. Certain it is, however, that upwards of 5,000 miners are now out with no present prospect of resumption. Meanwhile we note, as a matter of encouragement, that the miners' committee have applied for the appointment of a Voluntary Trades Tribunal as provided by Senator Wallace's bill, now a law, and already outlined in the TRADE REVIEW. The iron situation is less promising. Both sides seem nerving themselves for a long and stubborn contest, with the odds far more in the favor of operators this year than last. With a depreciated market the mill-owners can much better afford to lie idle for a time, while the number of non-union mills has increased in the meantime from eight to 16. The threatened strike, therefore, would not affect nearly so many mills as last year, and there would in all probability be enough mills, that would continue to run, to supply all present demands of trade. Nevertheless the situation is strained, and further developments will be watched with keenest interest.

WHY SOME MECHANICS DON'T GET ON.

We were much interested the other day in drawing from one of the oldest practical mechanics of Cleveland the secret of his success. Said he: "I have always made it a rule to do my work so well that it left a good impression on my employer." There is more in this than at first appears. Hard work is one thing; conscientious work is another. The hard worker may outwardly conform to all the requirements of the shop; he may always be in his place at the starting of the machinery; he may take short noonings, and he may be among the last to drop his tools at night, but after all he may utterly fail to get on in the world, and why? Let our experience informant answer: "*I know* of a young man of just that kind. He works hard enough and wants to succeed, but somehow he can't. He came to me for counsel, and I found that he was slighting his work. That is, in his anxiety to turn off a large amount, he neglected the finish which always tells on good work. The consequence will be that, unless he makes a change, when times are dull he will be one of the first to be dropped by his employer." Superintendents and foremen notice these defects more closely than many are aware. The man who slides over his task, who lacks in thoroughness, who lets an unfinished piece of work leave his hands, is marked. In the unwritten law of the shop he is barred from promotion, while the conscientious workman is morally certain of advancement. Is the tendency of the day in the direction of a better finish to work? We think it is. As machinery is brought into competition the strife will be to secure superiority in cheapness, simplicity and finish. Here it is that the thorough workman brings into play all the resources of his skill and honesty—his "mechanical moral sense," it has aptly been called. Here it is, too, that the slovenly, or careless, or hasty workman utterly fails. There are some forms of bad work that can be deftly covered up, but the compensations of life being the inevitable result—failure to him who does not put his heart in the work, success to him who not only does his task but does it well.

ANTI-STANDARD RAILROAD.

The newly fledged *Oil and Drug Journal and Paint Review* sees in the projected grand system of narrow guage railroads from Cleveland to Atlanta, as outlined recently in the TRADE REVIEW, a move in the direction of securing an independent, or anti-Standard, route for petroleum

shippers from this city to the South, all present routes, it is claimed, being virtually under the control of our great Oil Octopus. It says: "The present routes from Cleveland to Cincinnati seem inclined to aid the independent oil refiners, that is, to give them equal show with the Standard; but all the good intentions of these lines end at Cincinnati, as at this point the Standard takes the absolute and entire control of rates of freight on oil going south. The Standard, we might say, directly controls the only lines from Cincinnati south–both the Cincinnati Southern via Chattanooga, and the Louisville & Nashville via Louisville, Nashville, Chattanooga and Atlanta. In the C. S. R. R. Mr. Alexander McDonald, the agent of the S. O. Co at Cincinnati, is a director, and having large interests in the lumber trade along that road, from which we understand the road receives something like $50,000 per year income, the managers of the line have repeatedly declined to interfere with the rates of freight on oil to southern points. There is but one more outlet left, and that is the L. & N. R. R.; this road controls the lines from Cincinnati north via Louisville, and Frank D. Carley, of Chess-Carley Co., at Louisville, Ky., is the vice-president of the Louisville & Nashville Railroad." In view of these statements, renewed interest will be awakened in the Cleveland-Atlanta project—if it ever materializes from paper into rails and rolling stock.

How cheaply can iron be made in the South? The TRADE REVIEW, in a recently reported interview with a traveling man of experience and observation, showed how it is possible in that section to reduce the manufacture of iron to a minimum; upon the same subject the editor of the New York *Public* adds the following interesting information: 'Within the past two weeks we have personally seen No. 1 foundry iron produced in Western Virginia at a cost not exceeding $10.50 per ton. Very few concerns have attained so low a cost as this, it is probable, but in Virginia, West Virginia, Alabama and Tennessee there are already many that produce iron costing less than $15, which can be and is sold at a good profit in Northern markets, in competition with the best iron of Northern furnaces." If this is to continue, what will be the end? It looks as if a revolution in iron-making were brewing, comparable with which previous advances will appear insignificant.

WE trust that the members of the American Association of Mechanical Engineers will not be allowed to "get lonesome" during their coming visit to Cleveland. While much depends upon the efficient committee who have charge of the arrangements, a large responsibility also rests upon our citizens generally and manufacturers in particular. Papers of the utmost importance will be read before the association by gentlemen of wide reputation, and it is incumbent upon our home people that these papers are not read to empty benches. Let arrangements be made to attend all—at least one—of the sessions, and the Association will appreciate the courtesy.

NEW advertisements this week are: Forbes & Curtis, Bridgeport, Conn., patent die stocks: G. & C. Meriam & Co., Springfield, Mass.; "The Monolith;" J. W. Penfield, Willoughby, O., brick and tile machines; James Aitchison, Cleveland, manufacturer of machinists' specialties; the George Place Machinery Co., New York, second-hand machinery.

CLEVELAND MAY GET IT.

Interview with the Hall Safe and Lock Works People.

SPECIAL CORRESPONDENCE OF THE TRADE REVIEW.

CINCINNATI, May 8.—In an interview with Mr R. T. Pullen, Secretary and Treasurer of the Hall Safe & Lock Co., of Cincinnati, by a traveling correspondent of the TRADE REVIEW the following facts were obtained in regard to the talked-of removal from Cincinnati. Akron, Youngstown and other places, have made overtures but nothing definite as yet has been done. Mr. Hall returned from Springfield, O., today, favorably impressed with the place as a business center and its railroad facilities, but there are other places with which they are more favorably impressed than with Springfield, and those cities are Toledo and Cleveland. Mr Bolton, of the Cleveland Paper Box Co., has been looking up the matter in your city (Cleveland) and Mr. Hall will take a trip there as soon as he returns from San Francisco where he goes next week on business, and as soon as this is done it will be definitely settled as to location. Their establishment has become so large that there is no available space left for more buildings. They have now over 700 men in their employ, their pay roll amounting to $6,250 per week and their floor room, 275,000 square feet. Cleveland has been talked of as the more desirable of the two cities (namely, Toledo and Cleveland), and after Mr. Hall's return from the West they will know just what they are going to do. They are now building two large vaults for Cleveland parties, the Cleveland National Bank and Savings & Trust Co. of Cleveland.

A Flourishing Kent Industry.

A recent visit by a TRADE REVIEW representative to the Railway Speed Recorder Works at Kent found them running to their full capacity and branching out in all directions. While business in speed recorders has dropped off somewhat of late, owing to dullness in railroad matters, the other departments are kept constantly busy. Among other machinery turned out by these works are the following: Margach Patent Balance for Slide Valves, the castiron and glass sidewalk paving for the Patent Light Co., of Cleveland, and an ingenious device for fastening buttons on shoes. Besides they do a general jobbing trade. All of the machinery for making the button-fastener was made in these works, and Mr. M. H. Zellers is now perfecting a punch for fastening buttons by means of washers, the device already doing its work marvelously well. From a small concern six years ago, it has grown into extensive works to which were added a foundry 45x80 last fall and a further addition, now just completed, 27x80. Mr. W. D. Drake, of Cleveland, is general agent for the works.

Another Great "Standard" Fire.

A stroke of lightning set fire to the great works of the Standard Oil Co. at Jersey City, Thursday, resulting in the destruction of 12 large tanks, 18 cars, six barges, a dredge, three docks, and five brick buildings. Six men are believed to have been burned to death. The loss is roughly placed at $1,500,000. This disaster, following the great fire in the company's works in this city last winter, will prove a decided set-back to this great corporation.

So busily are J. W. Penfield's brick machine works at Willoughby engaged that a TRADE REVIEW representative found them running day and night, 76 men being given employment. To meet the demands of business, a portion of the old Oviatt Wagon Works is being occupied with Mr. Penfield's machinery.

THE TRADE REVIEW learns that the Lehigh Valley Railway are now building one trial car of the U. S. Car Co. pattern, and if satisfied with its working will adopt it as their standard coal car. The New York Central are also about to build two on trial.

MR. KENT'S valuable paper on steam boiler tests reaches its conclusion in this issue. It is well worthy of preservation in permament form.

The TRADE REVIEW, one year, $3.

EVAPORATIVE TESTS OF BOILERS.

A HIGHLY IMPORTANT PAPER READ BY WILLIAM KENT, M. E.,

Before the Engineers' Society of Western Pennsylvania, April 17, 1883.

Specially furnished the TRADE REVIEW by the Author.

[Concluded.]

Where it is important to secure great accuracy in a test, as in a competitive test between two boiler makers, or to determine whether or not a guarantee has been fulfilled, several precautions are necessary. If a water meter test is decided upon, the water meter should be tested to determine whether it correctly registers the water passing through it, or if a tank or set of barrels is used to measure the water, the capacity of such tank or barrels should be carefully weighed or measured, and an accurate count kept of the number of times they are filled and emptied. The scales upon which the coal is weighed should also be tested, and the number of drafts weighed carefully checked. The boiler should be inspected for leaks and any water blown off through the mud valve should be caught and weighed. To have the conditions fairly in favor of the boiler, it should be cleaned inside and out before the test, the brickwork should be examined to insure that there are no indraughts of air, the coal should be of a quality ascertained and agreed upon, and there should be a skillful fireman accustomed to the working of the same coal under the same kind of a boiler. The amount of coal upon the grate and the condition of the fire should be the same at the end of the test as at the beginning, the water in the boiler should be at the same level, and the steam at the same pressure. All of these precautions are quite easily observed, and should be within the comprehension of everyone who is entrusted with the care of a boiler. There is nothing fanciful nor theoretical about them.

As there is a considerable chance for an error of judgment in estimating the amount of coal on the grates and the condition of the fire at the beginning and at the end of a test, in is customary in accurate tests to raise steam in the boiler before beginning the test and to have the brickwork thoroughly heated as when the boiler is in its best cooking condition, then to draw the fires, removing all fuel and ashes from the grates and ash pit. A fresh fire is at once kindled with wood and shavings (the weight of which is taken as equivalent to 4-10 of the same weight of coal) and with weighed coal. At the end of the test, when the fire is in as nearly as possible the same condition as the fire which was drawn before the test, it is drawn and the grates and ash pit cleared, and the fuel which was on the grate cooled with water, screened and picked to separate the coal from the ashes, and the coal and the ashes weighed separately. In this manner the actual amount of coal used to evaporate a certain amount of water is much more accurately obtained than when the amount of fuel on the grate at the beginning and end of the test is merely estimated.

Where still greater refinement is desired it may be necessary to test the quality of the steam escaping from the boiler that is, to determine whether it is dry saturated, superheated, or whether it contains "entrained" water, or priming. A good boiler, properly proportioned, and not driven beyond its normal rating, and with good feed water, when there is no provision made for superheating, should give practically dry steam, that is, not containing above 3 per cent. of moisture. If there is a superheating surface attached to the boiler, the steam may not only be perfectly dry, but heated to a temperature considerably above the temperature due to its pressure, while with a boiler having insufficient water surface, insufficient steam space, certain kinds of bad feed water, or which is driven too hard, the amount of water carried over with the steam may be 10 or 15 per cent.

To determine the percentage of water carried out of a boiler in the steam is a matter requiring considerable skill and extremely fine instruments for weighing and for measuring temperatures. The operation is such a delicate one that there is considerable doubt of the accur-

acy of many priming tests which have been published, including among others those made at the Centennial Exposition. The method of determining the percentage of moisture in the steam consists in comparing the amount of heat contained in the mingled steam and water (as measured by the increase in temperature given by a certain weight of it to a certain other and larger weight of cold water) with the heat which would be contained in an equal weight of dry saturated steam. One plan of making this comparison, which was adopted at the tests at the American Institute in New York in 1871, is to condense all of the steam made by the boiler during the test by means of a surface condenser, and to determine its weight, and the weight and increase of temperature of the condensing water. Such a test is a very expensive and difficult one to make, and it is not often attempted. A much more common plan is to take samples from the steam at intervals, say about ten pounds each test, and pass it directly into a barrel containing a known weight, say 200 pounds, of cold water. The increase in temperature of this weight of water supplies the data which are inserted in a formula hereafter given, and the solution of the equation thus formed gives the percentage of dry saturated steam in that which escapes from the boiler. To obtain reasonably accurate results with this apparatus it is necessary to have a scale for weighing the barrel with the water in it to within one-tenth of a pound, and a thermometer giving readings accurately to a tenth of a degree.

Probably the most accurate apparatus for determining the quality of steam is the calorimeter of Mr. J. C. Hoadley described by him in a paper on a comparative test of boilers, published in Van Nostrand's Engineering Magazine in December, 1882. It consists of a cylindrical vessel of 24 in. turned copper encased in a jacket of heavy galvanized iron, the space between the outer and inner vessels all around and at the bottom being filled with two layers each $\frac{3}{4}$ inch thick of eider down surrounded by a $\frac{3}{4}$ inch layer of hair felt. It has a cover of similar construction, thickness and filling. The vessel is charged for experiments with 200 pounds of water. The steam drawn from the boiler instead of being discharged directly into the water is condensed in a tubular copper drum forming a surface condenser which is placed inside of the calorimeter. Above the condenser is placed a two bladed propeller attached to a shaft and crank, by means of which the 200 pounds of water covering the condenser is agitated in order to equalize the temperature of the water. The mingled condensed steam thus kept entirely separate from the water in the calorimeter is drawn off from the condenser and weighed on a delicate balance. The thermometer by which the increase of temperature of the water in the calorimeter is measured is so delicate as to admit of accurate readings to 1-100 of a degree. A test recorded by Mr. Hoadley shows that 6.3 pounds of steam at a pressure of 101.7 lbs. elevated the temperature of the water in the calorimeter from 44.98 degrees to 77.68 degrees, a rise of 32.7 degrees. The calculation from these data showed that the steam contained 3.15 per cent. of entrained water. Mr. John W. Nystrom by another apparatus, which is not described by Mr. Hoadley, but which the latter says is correct in principle but hardly admits of the degree of accuracy obtainable by Mr. Hoadleys calorimeter, obtained only about half of this per centage.

Other refinements which may be introduced into a boiler test are the measurements of the temperature of the escaping gases, of the force of the draught, of the temperatnre of the fire, analyses of the fuel and of the heated gases, and measurement of the quantity of air supplied. In the test by Mr. Hoadley before referred to, the temperature of the escaping gases and of the fire were measured, and an analysis was made of the amount of carbonic acid in the flue gases. From these data, he calculated that of the total heating power in the combustible (that is, the coal after deducting ash and moisture) 20.54 per cent. was carried up the chimney by the heated gases. The water in the boiler absorbed 75.03 per cent. and 4.43 per cent. was lost by radiation. The temperature of the waste gases in this case averaged 467 deg. Fahr. and the analysis of waste gases showed them to contain 11.34 per cent. by weight of carbonic acid.

The use of the pyrometer to measure the temperature of the waste gases furnishes an important check in many cases to the records obtained by weighing the water and the coal in a boiler test. As in the comparative test of the two-flue and the water tube boilers already referred to the high temperature of the pyrometer, 830 deg. to 1,000 deg. is also sufficient proof of the great waste of fuel in the two-flue boilers. When a boiler is working with fair economy, the temperature of the gases in the flue should not be over 500 deg. A low temperature of the gases, however, does not of itself indicate economical working of the boiler, as it may be caused by too great a supply of air to the fire diluting the waste gases and reducing the temperature of the fire, or too small a supply of air, causing the burning of the fuel to carbonic oxide only with the generation of only one third of the heat which its thorough combustion into carbonic acid would generate. It may also be caused by indraughts of air through the setting of the boiler between the grate and the flue. Occasionally a pyrometer will show a temperature below that of the steam in the boiler. This is almost certain proof of the existence of indraughts of air.

The force of the draught, or the difference between the pressure of the outside atmosphere and that of the heated gases in the chimney flue, is measured by the draught gauge, which is merely a U-shaped glass tube partially filled with water, one leg connected by a rubber or other tube to the inside of the flue, and the other exposed to the outside air. The partial vacuum in the chimney will cause the level of the water in the leg connected with the interior of the chimney to rise and that in the other leg to fall. The difference of the water level is a measure of the force of the draught. An ordinary draught for a chimney to a steam boiler is from $\frac{1}{4}$ inch to 1 inch, the amount of draught needed varying largely with different settings of boilers and with different fuels. The draught gauge is not a necessary part of the apparatus required in a boiler test, but its indications are often useful in comparisons of the working of one boiler with another, and it sometimes indicates the cause of the lack of economy or of capacity of any given boiler. At a test at which I was present a few months ago there were two boilers connected with the same chimney. The evaporative test showed that one boiler was giving a much larger capacity than the other, which was supposed to be equal in every respect to the former. The draught gauge showed that the slow working boiler had a draught of only 3-16 of an inch water column, while the other had $\frac{5}{8}$ inch, and indicated that an improvement could be made by altering the chimney connections, so that its draught would not be interfered with by that of the other boiler.

Determinations of the temperature of the fire, by means of the platinum pyrometer, as described in the paper by Mr. Hoadley, analysis of the fuel and of the heated gases, and measurement of the air supply are not often attempted in boiler tests, but they often furnish valuable data in experiments with new forms of boiler furnaces, with unusual fuel, or scientific researches. The analysis of the escaping gases would be very valuable in tests designed to improve economy, for the percentage of carbonic acid in the gases is the most accurate measure of the thoroughness of combustion.

Having completed the boiler test, and obtained the three principal data, pounds of coal used, pounds of ashes and refuse, and pounds of water, the calculations now have to be made to reduce the results of the test to a standard for comparison with other tests.

The quotient of the weight of water divided by the weight of coal gives what is called the evaporation per pound of coal under actual conditions, which conditions are stated to be the average temperature of the feed water and the average pressure of the steam. Dividing the evaporation per pound of coal by the ratio the combustible portion of the coal bears to its total weight, we obtain the evaporation per pound of combustible. These results have now to be reduced to the equivalent evaporation per pound of coal and per pound of combustible "from and at 212 deg." (that is, the equivalent number of pounds of water which would have been evaporated if the feed water had been supplied at 212 deg. and the steam evaporated at ordinary atmospheric pressure at the sea level, or 14.7 pounds per square inch), and to do this we have to multiply them by a "factor of evaporation" which we obtain as follows:

In Nystrom's Pocket-Book of Mechanics and Engineering there are two tables entitled Properties of Water and Properties of Steam, which were calculated by Mr. Nystrom from the formulae deduced from Regnault's experiments. Select from the Steam Table, column H, the total heat units above 32 deg. per pound of steam at the average observed gauge pressure, and from the Water Table, column h, the total heat units above 32 deg. per pound of water at the observed average temperature of the feed. Subtract the latter from the former and divide by 965.7 which is the latent heat of steam at 212 deg. and the quotient will be the "factor of evaporation," by which factor the evaporation per pound of coal and per pound of combustible under actual conditions is to be multipled to give the equivalent evaporation from and at 212 deg.

In an appendix to this paper * I have given a table for convenient reference containing the figures for total heat of water and steam at various temperatures, which is condensed from Nystrom's tables. I have also given a table of factors of evaporation for the feed temperatures and steam pressures used in common practice, which I have calculated from the formula $F = \frac{H-h}{965.7}$ in which F is the factor of evaporation, H is the total heat above 32 deg. of the steam at the observed gauge pressure, and h the total heat above 32 deg. in the water at the observed temperature of feed.

If a priming test is made to determine the quality of the steam, the following data and formula are used:

Let W = original weight of water in calorimeter
t = original total heat per pound of water in calorimeter
t' = final total heat per pound of water in calorimeter
w = weight of steam and water added from boiler.
H = total heat of steam at observed pressure
h = total heat of water at observed pressure
Q = quality of steam, dry saturated steam being unity

$$Q = \frac{1}{H-h}\left[\frac{W}{w}(t'-t)-(h-t')\right.$$

If $Q < 1$, then moisture = 100 (1-Q)
If $Q > 1$, then superheating in degrees = 2.0833 (H-h) (Q-1).

The figures for total heat of water and steam, H, h, t and t' are all taken from the steam and water table using the original and final temperatures of the water in the calorimeter, and the pressure of steam as data.

Another form of the priming formula is

$$w'' = \frac{w\,H + Wt - (W+w)\,t'}{H-h.}$$

in which w'' is the weight of dry steam contained in the mingled steam and water w drawn from the boiler.

When priming tests are made, a large number should be made at regular intervals during the progress of the test and the results averaged, in order to eliminate the effect of certain unavoidable errors of observation, and of the differences in quality of the steam at different times caused by more rapid evaporation and consequent greater disturbance of the water surface at one time than another. For a further discussion of the subject of priming tests I may refer those interested to the reports of the Judges of the Centennial Exhibition Group XX. pages 81 and 136, in which some of the precautions necessary to insure accuracy are described. A study of the priming tests of the fourteen boilers tested at the Exhibition which are given in this report shows some curious re-

[Concluded on Page 12.]

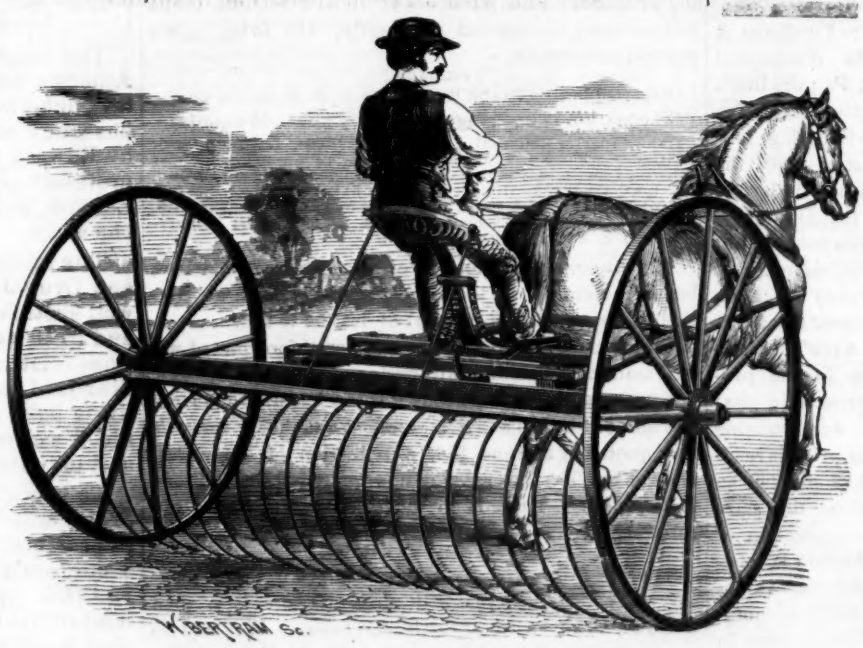
∴ The tables accompanying Mr. Kent's paper are very complete and exhaustive, and are more convenient for reference than as an aid to the understanding of his method. Owing to the pressure upon our columns, we are unable to give them this week, but should there be a desire for them we shall endeavor to put them in type.—[ED. TRADE REVIEW.

A New and Improved Sulky Plow.

A new farm implement just put upon the market is the Ball Sulky Plow, herewith illustrated. Among its features of excellence are the following; The plow being set on a swivel or turn-table, can be turned at the end of a furrow without taking the plow out of the ground. This feature alone makes it the most desirable plow for the farmer, as there is no other single lever plow made in the United States, it is claimed, that will do it successfully. With the improved "lift" the plow can be raised from the ground by a simple pressure of the hand on the spring attached to the lever, and can be easily done by any boy. It will do more and better work with less labor to the team, it is claimed, than any other. An advantage of this plow over others is, that it has no axle, the beam being held firmly by a bail upon which is fastened the turn-table, thus giving the plow free motion either way, not controlled by the tongue. The bail is attached to brackets, to which the spindles are fastened, and the spindles are so arranged as to give an eccentric motion, throwing one wheel up and the other down, and leveling the plow at any depth required. By this motion the second lever required on all other sulky plows is dispensed with. The absence of complexity is the leading feature of this plow. A. Ball & Co., Canton, will answer further inquiries concerning it.

A Popular Hay Rake.

The "Coates Lock Lever" Hay and Grain Rake, herewith illustrated, combines many points of superiority, chief among which we may mention: Its nice adjustment as to balance; its dispensing with any special skill in management, a boy being able to rake 20 acres per day; its light draught, the propelling force of the horse always acting directly on the top of the driving wheels on the same plane, consequently involving no loss of power or friction; the ease with which the rake can be tilted; the fact that each tooth is independent, thus adapting it to uneven surfaces, sandy and loamy soils, and finally, to the excellence of the material entering into its construction. No better testimonial to the merits of this machine can be given than the statement that over 8,000 were sold last year, increasing the grand aggregate of these machines sold since they were placed upon the market, about 88,000. Messrs. A. W. Coates & Co., Alliance. the manufacturers, are taxed to their utmost to fill orders.



"COATES' LOCK LEVER" HAY AND GRAIN RAKE.

THIRTEEN years ago the Pennsylvania Railroad Company determined to test the relative merits of English-made and Pennsylvania-made steel rails. They selected from among the English rails what is known as the Barrow rail and placed by the side of it rails from the works of the Pennsylvania Steel Company. Several days since these rails were examined, when, it is said, it was found that those made by the Pennsylvania Steel Company were superior to the others. Hereafter the company will use none other than Pennsylvania Steel Company's rails, and 69-pound rails of this make are being put down on the main line.—[Chicago Journal of Commerce.

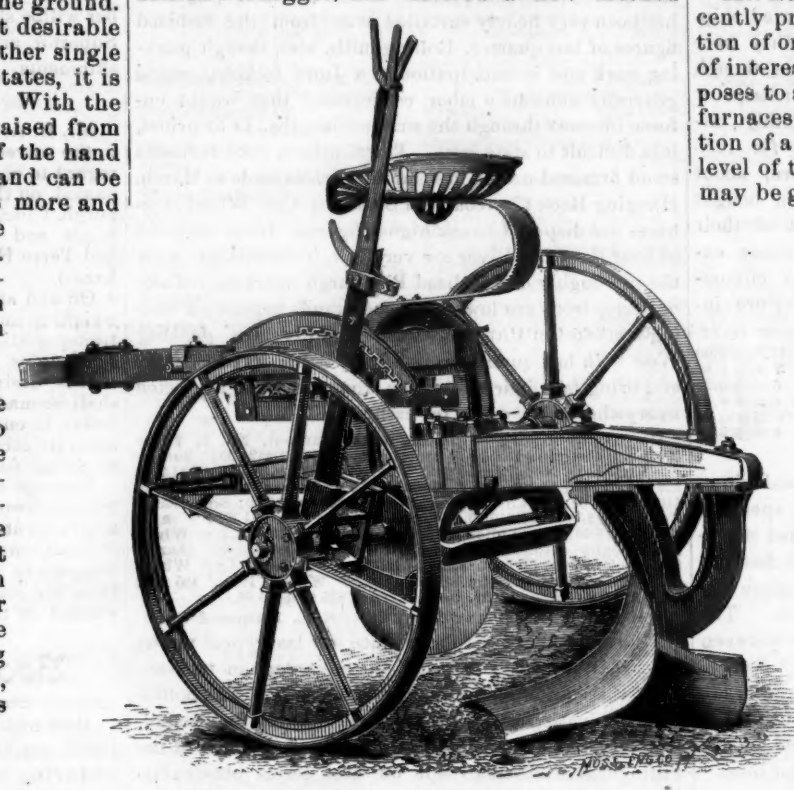
THE Cleveland TRADE REVIEW is emphatically in favor of another viaduct for the Forest City. In this, as in the advocacy of many other public measures, it has devoted much time and space.—[Indiana Manufacturer.

THE Brush Electric Light Co. will introduce their storage batteries for house lighting into New Orleans.

Science and Invention.

New Method of Melting Iron Ore with Scrap.

According to statements made in an English publication, a Dutch engineer of some note, named Ibruegger, has devised a new method



IMPROVED SULKY PLOW.

for melting iron ore with scrap, etc. In the furnace he has altered to suit the requirements of his new process a novelty is two sets of tuyeres, one above the other, with eighteen in each set. These tuyeres, which are in the form of a vertical slot, are directly connected with a circular tuyere ring. The particular feature of the cupola is that the bottom is a slightly inverted arch, pierced by two openings through which both blasts or imperfectly consumed gases of combustion, and the fluid iron can flow. Beneath this is a small chamber in which the iron collects, and is heated by the gases forced downward from the cupola above, which are supplied with the necessary air for combustion by a special tuyere leading from the main blast pipe. The chamber at the same time serves for preheating scrap, etc., which need only be pushed into the blast to dissolve it. Large quantities of scrap can be used by directly charging in the ordinary cupola; but it is claimed that in this process is economy of fuel, and greater facility in making sharp, strong castings and purer metal. The best iron for this is said to be common, low grade pig, holding considerable silicon and little manganese. To it from forty to fifty per cent. of scrap, etc., may be added. The total consumption of fuel is ten per cent. of the weight of the product. The process has attracted considerable attention and favorable comment.

New Method of Ore Reduction.

Mr. Levi D. York, of Portsmouth, Ohio, recently proposed a new method for the reduction of ores, a brief description of which may be of interest to our readers. The inventor proposes to abandon the usual method of feeding furnaces with fuel, and advocates the introduction of a mixture of gas and air at the tuyere level of the furnace. The gas to be employed may be generated by any of the present designs of gas producers (provided natural gas is not available), and is forced into the furnace through the tuyeres at any desired pressure, together with a suitable proportion of air. The mixture of gas and air may be heated before entering the furnace by passing through stoves designed for that purpose, thus insuring more perfect combustion near the point of admission. By the regulation of the volume of either gas or air admitted, any degree of heat may be obtained to suit the requirements of any special material operated upon. This method of feeding furnaces is, so the inventor claims, specially advantageous to the manufacture of pig iron, but at the same time can be applied in reducing any metals to the fluid state at a great reduction in the amount of fuel used and a considerable increase in production. The work of the furnace, moreover, it is claimed, can be much better governed than it is at present. The inventor also intimates that it may be possible to apply the method to the production of steel, but in regard to this point he advances no definite opinion, but claims that a ton of iron can be made with less than 500 pounds of coal, which is naturally a great reduction when compared with the amount used at the present time. In the event of natural gas being available, the cost of fuel would be still less. The superior quality of the iron turned out by this process is another point to which the inventor directs attention, stating, at the same time, that any of the present furnaces may be changed to work in this way at a very small cost. Mr. York, it is understood, is now making arrangements to erect suitable plant for the purpose of carrying out his process, and further developments will undoubtedly be awaited with interest.

Instantaneous Formation of Steam.

A firm in Paris have patented an invention for the instantaneous formation of steam, which permits of its use at once in the cylinder of the engine. A pump sends the required quantity of liquid between two plate surfaces, which are heated, and between which there is only a capillary space. The liquid spreading in a thin layer evaporates at once, without going at once into the so-called spheroidal state, and this steam acts in the cylinder as fresh formed steam. The speed of the pump is regulated by the engine, the pump being connected with the shaft of the engine.

POSTMASTER-GENERAL Gresham has approved a design for the new two-cent postage-stamp. The stamp contains a tablet upon which is a profile of Washington similar to that on the present three-cent stamp. Surrounding the profile is an oval band. In the upper part of the band the words, "United States Postage;" beneath the band a large "2," and at the extreme bottom of the tablet the words, "Two cents." The design will be returned to the engravers, after which the department will decide upon the color to be used. The color of the design is green.

Market Review.

OFFICE OF TRADE REVIEW AND WESTERN MACHINIST.
CLEVELAND, FRIDAY EVENING, May 11, 1883.

IRON ORE.

General apathy still reigns in the ore market. We can hear of little doing, and nobody expects a better market until the labor troubles are settled. The reported shipments for the week are 10,870 tons; last week they were 11,702 tons. Lake freights are also in suspense, though single trips have been taken at 95 cents, four trips at $1. Rhodes & Co., in their interesting monthly circular, say: "The sales of Lake Superior ore for 1883 delivery have been, as nearly as we can learn, about 500,000 tons—the largest portion having been bought by Bessemer rails mills, who have a large part of their product placed. As the production will not likely exceed 2,000,000 tons, this, considering all the circumstances, is not a bad show for the Lake Superior ore industry." We quote:

No. 1 Specular and magnetic Bessemer Ores per ton	$7.50@ 8.00
No. 1 Specular (non-Bessemer) ores per ton	7.00@ 7.50
Bessemer Hematites	5.00@ 5.25
Non-Bessemer Hematites	4.25@ 4.75
Menominee Range Bessemer	6.25@ 6.75
Menominee Range non-Bessemer	5.00@ 5.25

IRON.

PIG IRON.—H. S. Mould & Co. say of the local situation: "The past week has developed nothing specially new, though some grades of irons have weakened slightly. The better grades of both strong and soft foundry irons are firm, soft iron especially being in more demand and commanding better relative prices. The latest reports would indicate a compromise between workmen and mill men, which will undoubtedly have a more encouraging effect on the general trade, the trade now being uncertain as to what will be the condition after June 1. There have been no large sales in our vicinity, but a good, fair average volume of business." But little needs to be added. No furnaces in this vicinity have yet blown out, but in the East several have already done so. The progress of the labor troubles at Pittsburgh is closely studied. A strike is generally expected, but its duration is more a matter of conjecture. The odds would seem to be on the side of the mill men, first, because of the dull market, secondly, because the number of non-union mills has increased 100 per cent. since last year's strike, those at present so considered being: The Cambria Iron Works, Johnstown, Pa.; Everson & Macrum's mill, Scottdale, Pa.; Lauffman & Co.'s mill, Apoles, Pa.; the National Tube Works and W. D. Wood & Co.'s mill at McKeesport, Pa.; the Black Diamond Steel Works and the mill of Miller, Metcalf & Perkins, Pittsburgh, Pa.; the Cleveland rolling mill company, the American boiler plate and steel mill, the Lake Erie iron company, and the Britton iron and steel company, of this city; Wellsville, Ohio; the Ohio iron company at Zanesville; the Springfield iron company at Springfield, Ill.; the Vulcan forge and iron company of St. Louis, and the Mt. Hickory iron company of Erie, Pa. Summing up the situation as to pig iron, Rhodes & Co. say: "For the variety of reasons we have enumerated, there is a gradual but steady decline in the production of pig iron. The were 55 less furnaces in blast April 1 than January 1, and 82 less than were running April 1, 1882. That pig iron is too low in price is readily conceded by the consumer, and could there be an organized effort to curtail the production, the cure would be sooner effected than if left to the operation of natural causes. The fact of an over-production is, however, widely appreciated, and there is, wisely, we think, a determination on the part of producers not to accumulate any large stocks." Cash prices on board cars in Cleveland are as follows:

CHARCOAL PIG IRON.

No. 1 Lake Superior charcoal	$24.00@26.00
No. 2 Lake Superior charcoal	25.00@26.00
Nos. 3 and 4 Lake Superior	26.00@28.00
Nos. 5 and 6 Lake Superior	25.00@24.00
Nos. 1. 2, 3, 4, 5, Salisbury	35.00@37.00
Southern Car Wheel	28.00@33.00

BITUMINOUS AND COKE IRON.

No. 1 foundry, all lake ores	$22.00@23.00
No. 2 same	21.00@22.00
No. 1 foundry, lake ores, with cinder mixture	21.00@22.00
No. 2 same	20.50@21.00
No. 1 foundry, native Ohio ores	21.50@22.50
No. 2 same	20.00@21.00
No. 1 silvery, native Ohio ores	19.00@20.00
No. 2 same	18.00@19.50
No. 1 gray forge, red short	20.00@21.00
No. 1 gray forge, neutral	19.00@20.00

CINCINNATI.

[Reported for the TRADE REVIEW by Rogers, Brown & Co.]

The story to be told about the market is short. There is no market. The users of iron buy what is absolutely needed to prevent their works stopping, and do no more. It is doubtful if, for years, the smaller foundries and mill yards have been so bare of stock as now. Many of them complain of decreased business, their own customers pursuing the general plan of putting off making new contracts, and buying only when compelled to. That this policy will be pursued in every branch of the trade, so long as prices can be forced still a shade lower, there can be no doubt. The only remedies, apparently, are the heroic ones, and these there seems to be a general disposition to apply. It will be found by the end of this quarter, that the product of iron ore and pig iron has been very heavly curtailed even from the reduced figures of last quarter. Rolling mills, also, though pushing work now in anticipation of a June lockout, would generally welcome a labor controversy that would enforce idleness through the summer months. As to prices, it is difficult to state facts. The Southern coke furnaces stand firm and united in sustaining prices made in March. Hanging Rock Charcoal and Southern Car Wheel furnaces are disposed to ask higher figures. Irons made on or near the Ohio River are very low, in sympathy with the thoroughly demoralized Pittsburgh market. Lake Superior irons are lower. Some brands heretofore finding a market in Pittsburgh and vicinity are pushing West with low quotations. Silvery softeners are scarce and bring fair figures. Forge irons are much neglected everywhere. We quote for cash:

Hot Blast Foundry.—Hanging Rock Charcoal, No. 1, $23 50@$25 00; Hanging Rock Charcoal, No. 2, $22 00@$24 00; Southern Charcoal, No. 1, $22 50@$23 50; Strong Coke, No. 1, $21 00@$22 00; Strong Coke, No. 2, $20 00@$20 50; Strong Coke, No. 3, $19 00@$20 00; Soft Stone Coal, No. 1, $20 00@$21 00; Soft Stone Coal, No. 2, $18 00@$19 00. Forge—Strong Neutral No. 1 mill, $18 50@$19 50; Cold short No 1 mill, $18 00@$19 00. Car Wheel & Malleable—Hanging Rock Cold Blast, $31 00@$33 00; Hanging Rock Warm Blast, $25 00@$27 00; Southern Car Wheel Iron, $27 00@$28 00; Lake Superior Car Wheel Iron, $25 00@$26 00; Lake Superior Malleable Iron, $25 00@$26 00.

[Reported for the TRADE REVIEW by E. L. Harper & Co.]

There is no change to note since our last report unless it be, that buyers are afforded the advantage in transactions, the market being weak and unsteady. The Southern combination and other furnaces holding for remunerative prices are in a measure neglected, because of the willingness of others to sell on best terms obtainable, which process will continue until the supply of the willing ones is taken up. Some consumers to preserve their usual "mix" are willing to pay prices asked by their favorite furnaces. There may be great wisdom in the tenacious holding to paying prices, and piling the iron in preference to parting with it at a loss, but the "good time coming," to many seems removed into the "sweet bye and bye." The tide will turn some time, and though the new furnaces going into blast will probably avert the extraordinary experiences of '79 and '80, fair crops and ordinary commercial prosperity, will bring again general satisfaction.

CHICAGO.

[Reported for the TRADE REVIEW, by A. B. Meeker & Co.]

The market is unchanged from last week. We quote:

Lake Superior Charcoal, 1 & 2, $25 00@$26 00; Lake Superior for Car Wheels, No. 3, $27 00@$28 00; Lake Superior for Car Wheels, 4 and 5, $28 00@$30 00; Scotch, according to brand, No. 1, $31 00@$32 00; Hanging Rock, Charcoal, No. 1, $25 00@$26 00; Hanging Rock Coke, No. 1, $24 00@$25 00; Anthracite, No. 1, $24 00@$27 00; Anthracite, No. 2, $23 00@$25 00; American Scotch, No. 1, $23 00@$28 00.

MANUFACTURED IRON.—We quote no change in prices, but at present figures the market is steady, with no particular disposition on the part of dealers to sell.

WROUGHT PIPE—The discounts heretofore quoted are still maintained, with a fair business.

SCRAP IRON.—No. 1 wrought scrap has dropped from $22 and $24 to $20 and $22. Sheet and hoop scrap is now quoted at $12 and $14, a reduction of $1. Cast borings are 50c. lower, being now quoted at $11. Trade is very dull. There is no movement whatever of old rails.

HARDWARE.

Trade is fair only. Traveling men report hard picking, and collections are a little slow. There is a good demand, however, for agricultural tools. We add to our quotations on wrenches, P. S. & W. Machinists', discount 50 and 10; Agricultural, discount, 20.

NAILS.—A fair demand for nails is noted, at $3.10, 60 days, or 2 per cent. off for cash. This is about 20c. under card. Stocks are reported low on 8d. The Western Nail Association met at Pittsburgh Thuasday, at which it is understood that, in view of light stocks and brisk demand, together with the fact that a strike is deemed inevitable, they will at one advance prices. This involves no change in the card but means that there will be no such shading of prices as has been the case for some time past, amounting to from 10 to 16 per cent.

COAL.

About all the mines in the Tuscarawas and Mahoning valleys are mining, and the probability of their continuing so has been strengthened by the decision of the operators in the latter not to reduce the price of mining. Local prices remain unchanged. Freights are inactive, as low as 60c. to Chicago being accepted.

OILS.

The market in lard oil is better, and prices are stiff. No. 1 has advanced 1 cent. being now quoted at 75a78c.

LUMBER.

There has been no material change in the prices ruling all winter. We quote small bill stuff, 16 feet and under, $1 lower, viz: $13; shingles, clear butts, $2.75a $3.00, and making, flooring and drop sidinge, $2. The Chicago Tribune estimates that fully 50,000,000 of lumber willbe shipped from the different ports on Lake Superior, an increase of 33⅓ per cent. over last year's shipments.

Important to Travelers.

Mr. E. A. Ford, General Passenger Agent, announces to the traveling public that the following new rule in regard to checking baggage, will take effect on the date named, on the lines of the Pennsylvania Company, Pittsburgh, Cincinnati and St. Louis Railway, Chicago, St. Louis and Pittsburgh Railroad, (Pan-Handle Route), and Terre Haute and Indianapolis Railroad, (Vandalia Line.)

On and after June 1st, 1883, no single piece of baggage weighing more than 250 pounds will be accepted for transportation in baggage cars by the above named Companies.

It is desirable that application for baggage checks shall be made a sufficient time prior to the departure of trains, to enable agents and baggage masters to secure accurate records, weigh baggage, and to collect the proper charge for excess weight.

Baggage agents will receive and check baggage for any train as nearly up to the time of departure of such train as proper attention to the above requirements will permit.

The Company will not agree, however, to forward baggage by any specified train unless the above conditions are complied with; otherwise baggage will be forwarded on the next following train.

Books, Newspapers, Etc.

ROWELL'S American Newspaper Directory for 1883, consisting of 1,124 pages, is at hand—an enduring monument of painstaking care on the part of the publishers. It continues to be the leading publication of the kind in this country and is an invaluable aid to advertisers.

THE May number (a splendid one, by the way) includes the fourth year of The Art Amateur, and the index for the last twelve months gives a vivid picture of the surprising wealth of designs and instruction contained in this invaluable magazine. Price $4; single numbers, 35 cents. Montague Marks, publisher, 23 Union Square, New York.

THE bright eyes of the boys and girls of America will sparkle at the sight of the May St. Nicholas, which, among other attractions, has a new serial story (splendidly illustrated) by Edward S. Ellis, entitled "Swept Away," a profusely pictured article on bird-life, by Lucy Larcom, and a "Chalk Talk" by Frank Beard, the artist.

THE initial number of the Independent Oil and Drug Journal and Paint Review is at hand, well sustained from an advertising point of view and fresh and vigorous in its treatment of questions relating to its special line. It is anti-Standard from tip to toe and bids fair to lead a lively fight against that great monopoly. We bid it welcome to the journalistic fraternity—and may its shadow never grow less.

To begin to enumerate the attractive features of the May Wide-awake would be well-night impossible. Joaquin Miller tells about "Mr. Tennyson's Fairies" very pleasantly; Rev. F. E. Clark represents the business men of Portland in his third and last paper on "Our Business Boys"; Hovenden's full-page drawing for Burns's famous lines, "A Man's a Man for a' that" is most charming, and as for the remainder of the contents—well, it is just as interesting as it can be. D. Lothrop & Co., Boston, are the publishers.

THE full, complete and exhaustive reports of Secretary James M. Swank of the iron and steel industries of the United States and of Pennsylvania (a separate pamphlet) are now being distributed to the members of the American Iron and Steel Association. For copies of each the TRADE REVIEW is indebted to Mr. Swank. These reports have long since taken the highest rank for reliability, and in the pamphlets under review the compiler has grouped facts of great suggestiveness in clear and comprehensive form. Mr. Swank is performing an invaluable service to trade in the sphere which he so ably fills.

THE Ohio Valley Stove Works, at Bellaire, are being enlarged.

Cleveland Wholesale Prices.

[The lowest quotable prices are given in all cases.]

HARDWARE.

Adzes.

Carpenter's	per doz $18 40
Ship	" " 18 75
Heavy railroad	" " 19 50

Axes.

	per doz.
James' 2d qual	$7 00
Buckeye	8 00
" doub. bitt	15 00
Hunt's	9 50
Mami's	8 00
Lippincott's Crown	8 50
Cut More	9 00
Peck's Double Bit	22 00
"Champion Blade	11 00
Good triple silver steel	11 50

Axles.

Standard list,
Nos. 1 to 6, 50 & 10 off
Nos. 7 to 14, 50 & 5 off
Nos. 15 to 18, 45 off
Nos. 19 to 22, 50 & 5 off

Anvils.

	per lb.
Eagle, Amer	10c dis 20
Wright's	11¼c@11c
Armitage's Mouse Hole	9½c@9¾c
Trento	10¾c
Wilkinson's	10½c

Anvil Vise and Drill.

Millers Falls Co. $28 ....dis 20
Cheney Anvil and Vise dis25&2

Augurs and Bits.

C S cut augers .....dis 50&10
do do do bits .... 50&10
D C gimlet do Ives .. dis 50
Snells bits .....dis 40&10
Russell Jennings' augers, dis 10&10&10
Cook's pat augur.....40&10

Animal Pokes.

Akron	$ 3 50
Camp's	4 00
Berea, per doz	4 00
Eagle, per doz	5 00

Apple Parers.

Domestic&Reading ℔ doz.$7 50
Turn Table 5 00

Bolts.

Machine	dis 70
Plow	dis 50
Plow, R. B. & W	dis 40
Cast Iron Barrel Shutter, etc	dis 55&10
Cast Iron Chain (Sargent' list)	dis 60&10
Ives' Pat. Door Bolts.	dis 50
Wrought Barrel	dis 55&10
Wrought Square	dis 55&10
Wr'g't Shut'r, all iron, Stanley's list	dis 50&10
Tire, R. B. & W., new list	dis 70&10
Stove, American Screw Co.'s	dis 40
B. B. & W	dis 40
Bolt Ends 16c. per lb. net	60

Bellows.

	Dis
Bl'ksmith's com new list, 45 ℔ ct	
Moulder's new list, dis 25 ℔ ct	
Hand, new list, 25 per cent	
Butts.	Dis
Wrought brass	65&10
Cast, loose joint	60&10
Pin, loose	55&10
Wrought, fast joint narrow	50&10
Wrought fast joint broad	50&10
Wrought loose joint broad	55&10
Wrought table and back flaps	50&10
Loose joint, without acorns	55&10

Ten per ct. extra dis for cash.

Boiler Plates.

"Gaylord"-Standard Quality.

C. No. 1	4 50
C. H. No. 1 Sheil	4 75
C. H. No. 1, 50,000	5 25
C. H. No. 1, 55,000	5 75
C. H. No. 1 Flange	6 50
Firebox	
T. S., 60,000 (as per)	6 50
T. S., 65,000 (act of)	
Homo. Steel, 70,000 (of Cong)	7 50

Heads, ¼c ℔ lb. extra.
N.B.-Eastern brands of boiler plate at from 2-10 to 3-10c ℔ lb less than above prices.

Boiler Tubes.

"National" Standard Gauge 1 inch to 10 inch.....dis 37½
"National" Standard Gauge 11 inch to 15 inch . dis 25
"National" Special Locomotive Tubes ..... net list

Bag Holders.

Sprengle's Pat, $18.00 per doz 40 per cent. dis.

Boiler Makers' Tools.

Doty's Power Shears	net list
" Hand Lever Shears	net list
" Power Punch	net list
" Hand Punch	net list
Steel Screw Punch	net list
Iron Screw Punch	net list
Boiler Plate Rolls	net list
Buffalo Forges & Blowers	dis 20
Watson's " "	net list
Spring Tube Expander	dis 15
Roller Tube Expander	net list
National Tube Cleaner	dis 20
Wire Flue Brushes	net list
Anvils—'Peter Wright'	12½ ℔ lb
Solid Box Vises	net list

Cleveland Stamped Elbows

Genuine Russia Iron

4½inch, per doz	5 50
5 do do	7 50
6 do do	9 50
7 do do	11 00

Charcoal Iron

4½ inch, per doz	2 50
5 do do	3 50
6 do do	4 25
7 do do	5 50

Discount 33⅓ per cent

Planished Amer. Russia Iron

7½ inch per doz	5 00
4 do do	6 50
5 do do	9 50
6 do do	8 05

Cutlery.

Meriden Cutlery Co., (Table)	
Am. Miller Bro's Cutlery Company	dis. 25
Humason & Beckley, Pocket.	dis. 40
Naugatuck Cut. Co.	list net
Aaron Burkinshaws poc	dis.25
Akron Cutlery Co	dss 45

Chisels.

Hot and cold cutting	℔ lb 30
Railroad track	30
Machinists	30
Mallet head	50
Jape	50
Packing	50
Stone cutters	50

Crowbars.

Cast steel	℔ lb 7
Iron, steel points	5c

Cutlery, Pocket and Table.

Meriden Cutlery Co , table net
Am. Miller Bros.' Cutlery Co ..... dis 25
Humason & Beckley, pocket 33⅓
Naugatuck Cutlery Co. list net
Aaron Berkenshaw's pocket dis 25
Fram Cutlery Co., table net
Cleveland Cutlery Co. dis 25
Miller Bros., pocket.... 33⅓

Coopers' Tools.

Bradley's	dis15@20
Braton's	dis15@20

Chains.

Coil by cask,

3-16	¼	5-16	⅜	7-16	½
10½	9	8	7	6½	6¼

Drills and Drill Stocks.

Blacksmiths', each $2.50 dis 10
Blacksmiths', self-feeding, each 7.50 dis 20
Breast, P. S. & W ...dis 20&10

Drawing Knives.

Peck, Stow & Wilcox	dis 70
Witherby's	dis 65@10
Nobles Mfgr. Co	15
Adjustable handle	20

Emery and Sand Paper.

Regular Numbers	℔ lb 6c
Flour and F. F	℔ lb 4c
B. & A. Emery Paper	dis 30&5
Sand paper	dis 30&5

Enameled & Tinned Ware.

Kettles	dis 50
Sauce Pans	dis 30
Tinned Sauce Pans	dis 30

Files.

Parkin's $5 to £	dis 50 ℔ cent
E.M. Boynton's, new list	dis 25
J. & Riley Carr	4.50 to £.
Johnson & Bro	dis 50
Butcher's	4.50 to £.
Walter Spencer & Co.'s "Diamond"	4.50 to £.
Fisher's	4.75 to £.
Moss & Gamble	4.50 to £
H. Disston & Sons (new list)	dis 50 per cent
Heller Bros.' Horse Rasps	dis 35
Nicholson	dis 50
New American	dis 50
Union File Co	dis 50

Grindstones.

Beroa	1@1½ ℔ lb
Ohio	1¼@1½ ℔ lb
Nova Scotia	1¼@1½ ℔ lb
Lake Huron	1@1½ ℔ lb

Hammers.

Maydole's	dis 15
Cheney's	dis 25
Hartford Hammer Co	dis 20
Humason & Beckley	dis 50
Verree	dis 5
Magnetic Tack, Nos. 1, 2, 3, $1.25, $1.50 and $1.75	dis25&10
Nelson Tool Works	dis 40&10
Warner & Noble's	dis 5
Kip's	dis 15

Hatchets.

Buckeye ..... Shingling,
Nos. 1, 2, 3,
℔ doz $7 50, $8 00, $8 50, dis 33⅓
Claw,
Nos. 1, 2, 3,
℔ doz $8 25, $8 75, $9 25, dis 33⅓
Lathing,
Nos. 1, 2, 3,
℔ doz $7 50, $8 00, $8 50, dis 33⅓

Hinges.

Champion double acting spring hinges ..... dis. 30
Screw & Strap 8@12 in. .. $5. net
Gravity Locking Blind Hinges, Sargeant & Co. 70&10
Clark & Co ..... 70&10

Lock..

Whipp e Mfg Co	45 & 10
Norwalk Lo Co	45&10

Nails.

20 to 60d	$3 15
8 and 9d	25
6 and 7d	50
4 and 5d	75
3d	1 50
2d	2 75
3d fine	3 00
2d fine	3 75
⅞ inch	3 00
4d barrel	1 00
1¼ inch barrel nails	1 50
1¼ do do do	1 75
1 do do do	2 50
⅞ do do do	3 00
Cut spikes, all sizes	35
Clinch nails, all sizes	1 75
Casing and box nails	75
Finishing nails,	$1 25
Tobacco nails,	50

Nuts and Washers

Nuts, square	7¾c off list.
Nuts, hexagon	8c. off list.
Washers	.7c off list.

Nuts, Bolts, etc.

Square & Hex. Nuts	.8 off list
Washers	.7c. off list
Machine Bolts	dis 70
Bolt Ends	dis 70
Boiler Patch Bolts	net list

Picks.

Railroad, 4 to 5 lbs. doz	$6 60
5 to 6 lbs.	7 20
to 7 lbs.	7 80
7 to 8 lbs.	8 40
Railroad Tamping Pick 7 to 8 lbs. doz	10 80
Mill Picks per lb	75

Planes.

Ohio Tool Co	dis 20
Sciota	dis 25
Bailey's Pat. Adjstbledis	20@10
Sandusky, fancy	dis 15
Buckeye	dis 20
Ogontz	dis 25

Rivets.

Iron	dis 40
Tinned	dis 40
Copper	dis 5 0

Rules.

Stanley ..... dis. 70 &10

Squares.

	Dis
Steel or iron, case lots	50
Try squares and T bevels	40

Spikes—WROUGHT

All lengths by ¼ inch 4½c
do do do 5-16 ..... 3½
do do do ⅜, 7-16 & ½ in 3¼

Shovels and Spades.

Ames' new list, July 1, 1881,	dis 15
Old Colony	dis 15
Remington's (Lowman's Patent)	dis 30
Bishop	dis 50
Chisholm	dis 25@30
Rowland's	dis 40 and 10
Griffiths	dis 40&10

Sad Irons.

From 4 to 10 lbs. per lb	3½ net
Self-Heating	℔ doz $9 net
Tailors	℔ doz $18 net
Gleason's Shield and Toilet	dis 25
Mrs. Pott's Irons, double pointed	dis 35
Mrs. Pott's Irons, square back	dis 35
Enterprise Star Irons	dis 35
Combined Fluter and Sad Iron	℔ doz $15, dis 15

Saws.

Disston	dis 20
Disston's Circular	dis 40
Disston's hand panel, rip, &c	dis 20
Boynton's lightning cross cut, new list	dis 40
Boynton's circular and mill	dis 40
Boynton's ice	dis 25
Boynton's lightning hand panel and rip	dis 25
Livingston's butcher and kitchen	dis 20
Livingston's framed wood Nos. 101 102 103 104 105 doz $10 8 50 10 7.50 6 20 net	
Peace circular & mill	dis 40
Peace hand panel and rip	dis 25
Peace band saws, all widths	dis 10

Scales.

Hatch, Counter, No. 171	℔ doz. $42, dis 37½&10
Union Platform	$6, dis 45
Fairbanks'	dis 20
Buffalo Scale Co	dis 40
Forsyth Scale Co	dis 25
Howe's	dis 20&10
Chatlilon's Eureka	dis 25
Family Universal	dis 50
Scale Beams	dis 33⅓&10

Screws.

	Dis
Flat head iron or steel [new list] per cent	dis.50&10
Flat head brass	50&10
Round head iron or steel	45&10
Round head brass	40&10
Brass and Silver capped.	30
Japanned, list of Plain Screws	40
Coach, patent Gimlet point, list per 100	65
Lag, taper points	65
Bed	10
Machine, flat head, iron.	55
round head, iron	50
Bench, iron	55&10
wood, beech, per doz $3	10
wood, hickory	20&10

Tinners' Tools & Machines.

Machines (P. S. & W.) list add 10
Tools (P. S. & W.) ..... add 20

Plumbers', Steam and Gas Fitters' Supplies.

Wrought Iron Pipe	dis 70
Malleable Iron Fittings	list
Grey Iron Fittings	dis 50
Steam Brass Goods	dis 55
Water " "	dis 50
Ludlow Gate Valves	dis. 20
Register Gauge Cocks	net 1 00
Montg'ry Gauge Cocks	$1 each
Steam Gauges	dis. 40
Steam Guages 5 in.	net dial per doz 30 00
Scotch Glass Tubes	dis. 60
Tools	special.
Duplex Injectors	net.
Soil Pipe & Fittings, Mott's List	dis. 30
Sinks, Mott's List	dis. 25
Copper Bath tubs, sinks, etc	dis. 25
Galvanized Iron Boilers "Scaifes."	dis. 50
Marble Slabs, Counter-sunk net per ft.	$ 1 25

Sheet and Tank Rivets.

"Norway."

All sizes ..... dis. 15

Boiler Rivets—"Albany."
⅜, ½, 11-16, and ¾ in. diam. 5 50

Valves. Dis.

Jenkins' Patent Gate Valves	35
" " Globe "	40
" Standard Packing "	20

Vises.

Solid Box, list of July 1, '79,	dis 40
Solid "Crown" (A. H. Hildick)	40 to 100 lb. 15c net
Solid, Peter Wright's	15½
Solid, Wilkinson's	13½
Parallel, Parker's	dis 40
" Simpson	dis 20
" Prentiss	dis 15
Saw Filers, Hopkins'	℔ doz $17.50, dis 10
" Wentworth's	9 00
Reading	dis 45&10
Lowell Hand Vises	dis 20
Richardson's Vise and Anvil	dis 25

Wrenches.

Coe's genuine	50
Girard Standard	dis 50 & 10
Mechanics' 10 and 10	dis. 50
P. S. & W. Mechanics	dis 50&10
Agricultural	dis 20

Wire.

Brass and Copper	dis 25
Bright & annealed, Nos. 0 @ 18	dis 50@55
" " Nos. 19 @ 26	dis 60
" Nos. 27 @ 36	dis 65
Coppered Nos. 0@18, dis 45@50	
Galvanized, Nos. 0@18, market list,	dis 40@42½
Tinned, Nos. 0 @ 18, dis 45@47½	
Cast steel	dis 40
Tinned Broom Wire, Nos. 18 @ 25	dis 55
Annealed Fence, Nos. 8 and 9	dis 55
Annealed Grape, Nos. 10 to 14	dis 55
Galvanized Telegraph, Nos. 7 to 9	℔ 1
Galvanized Telegraph, Nos 10 to 11	℔ lb 8¼c
Galvanized Telegraph, No. 12	℔ lb 10½c
Fence staples	℔ lb 5½@5¾c
Fence Staples, galvanized,	℔ lb 7@7¼c
Stubs Steel Wire	$6 00 to dis 30
Barb Wire, painted	7 ⅛8
Barb Wire, galvanized	¼c
Crucible Steel Ropes fro in. at 9c to 1¼ in. at	52c
Best Selected Iron Ropes from 3-16 in. at 3c. to 1¼ in. at	33c

TINNER'S STOCK.

Tin.

Banca,	per lb. 25
Straits	" 23c
English	" 24½c
Bar	" 26c

Tin Plate,

IC 12x12 charcoal	$ 6 75
IC 14x20 do	6 75
IX 14x20 do	8 50
DC 12¼x17 do	7 00
DX 12¼x17 do	9 00
DXX, 12¼x17 do	11 00
DXXX, 12¼x17 do.	13 00
IC, 20x28 do	13 75
IX, 20x28 do	17 25
IC, 14x20, Best Roof	6 00
IX, 14x20, do	7 75
IC, 20x28 do	12 00
IX, 20x28 do	15 50
IC, 10x14 Best Coke	6 00

Solder.

Half and Half, in bars	15
No. 1 do	14
Spelter Solder	25

Pat Planished Sheet Iron

[A] per lb 10	8-10c
[B] 9	8-10c

Nos	10	15	21	25
to	14	20	24	& 26
Com	3-40	3-60	3-75	3-95
Char	5-60	5-60	6-00	6-20

Sheets over 28 in. wide ¼c extra.

Zinc.

Sheet, cask	7c
Sheet, open	7½c

BRASS.

Cash prices for Roll and Sheet Brass. For less quantity than 100 lbs. add 3c per lb.

High Bra

All Nos not thinner than No. 28, wider than 2 in. not wider than 14 inch 30c
All Nos to No. 28 inclusive, and widths over 14 to 20 in. inclusive 35c
All Nos to No 28, inclusive, and widths over 20 to 30 in. inclusive 38
½c per lb advance on each No above Nos 28 to 38, inclusive.
All Brass thinner than No. 8 is Platers' Brass at 53c
Sheets 24x48, and all sheets cut to particular sizes and lengths under 30 inches, in width wider than 2 inches 37c

Low Brass.

4c pr lb. more than High Brass
Gilding metal 8c per lb. more than High Brass
Platers' or Gold Metal

In Bars	48c
Sawed	51c
Planed or Polished	54c

For Slitting

Metal in width in. to ¼ in. to No. 28, inclusive, 1c per lb., advance.
Metal, in width 2 in. to 1 in. thinner than No 28, 2c per lb. advance
Metal, in width ⅛ in to ¼ in thinner than No 28, 5c per lb advance.
Metal ¼ in in width and less, 10c per lb. advance.
Any of the above widths cut to particular lengths add 7c per pound.

COPPER.

Lake ingot	16⅛@ 7c
Baltimore	15¼ 15⅛
Arizona	15⅛@16c

Sheathing Brazier Copper, Bolts, etc.

All sizes, 16 oz. per sq. foot. and over, per lb 30c
and over per lb 30c
Brazier's Copper, ordinary sizes, under 16 oz. and over 12 oz. per sq. foot, per lb. 32c
Brazier's Copper, 10 oz and 12 oz. per sq. ft. per lb. 34c
Brazier's Copper lighter than 10 oz. per sq. ft. per lb. 36c
Circles less than 84 inches in diameter ... per lb. 38c
Circles 84 inches in diameter and over ..... per lb. 30c
Segment and Pattern sheets per lb. 33c
Locomotive Fire Box sheets per lb. 30c
Sheathing Copper, over 12 oz. per sq. ft. ... per lb. 28c
Bolt Copper ..... per lb. 30c
Copper Bottoms per lb. 31@32c
No copper is Sheathing except 14x10 inches, and not to exceed 34 oz. to the sq. ft.

Tinning.

14x48 ..... per sheet 6c
All other size sheets, 2½c per square foot For tinning both sides, double the above amount

LEAD.

Amerc'n, ℔ lb	5c
Bar, ℔ lb	6¾c dis 10 per ct
Pipe,	6¾c dis 10 per ct
Sheet, ℔ lb	7¼c dis 10 per ct
Tin-lined pipe	15c dis 10 per ct
Block	8c.
Chilled Shot	8c

Babbitt Metal.

Best Babbitt Metal, No. 3	14 X ... 42
Best Babbitt Metal, No. 2,	16 XX .. 46
Babbitt Metal, No. 1,	18 XXX .. 50
Babbit Metal, C	20
Babbit Metal, B	24
Babbit Metal, A.	32

Dis 40 per cent.

IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	2 10
4½ to 6 by ⅜ to 1 inch	2 20
1¾ to 6 by 1¼ to 1½ inch	2 50
1¾ & 1¾ by ⅜ to ¾	2 20
1 & 1¼ by ⅜ to ¾	2 30
⅞ & ¾ and ⅜ by ⅜ to ½	2 50

Round.

1 to 1⅞ inch	2 20
2 to 2¾	2 30
2¾ to 3¼	2 60
3¾ to 4	3 10
4¼ to 4¾	3 60
4¾ to 5	3 80

Square.

1 to 1⅞ inch	2 10
2 to 2¾	2 30
2¾ to 3¼	2 60
3¾ to 4	3 10
4¼ to ⅞	2 20

Heavy Band.

1½ to 6 by ¼ and 5-16 inch 2 30
1 to 1½ by ¼ and 5-16 do 2 40
⅝ to ⅞ by ¼ and 5-16 do 2 60
⅞ to ⅛ by ¼ and 5-16 do 3 00

Half Oval and Half Round.

Wagon box iron ¾ and ⅞ 3 70
1-10c per lb extra will be charged for cutting to specified lengths

Light Band.

1¼ to 6 by ¼ to 3-16.... 2 70

Hoops.

1¼ to 2 , Nos 16 to 18	3 10
1¼ to 4 do 13 to 15	3 00

1-10 extra for each gauge lighter

Sheet Iron.

No 22 to 24	3 70
No 25 to 26	3 90
No 27	4 10
No 28	4 50

English Steel.

Best cast	℔ lb 16c
Extra cast	16¼c
Round machinery	10c
Swaged, cast	18c
Best double shear	15½c
Blister, 1st quality	13c
Refined tool steel	16¼c
Spring calking	7¼@7½c
German steel, best	11c
2d quality	10c
3d quality	9c
Sheet cast steel, 1st quality	15½c
2d quality	14½c
3d quality	12½c

American Steel.

Best brands of refined cast steel, ⅜ to 2 inches	12c
Crucible cast	7c
Open-hearth ditto	4½c
Hammer cast steel	9c
Spring cast steel	7½c
Bessemer and open-hearth spring	5c
Ditto plow	4½c
Steel boiler plate	6½@7c
Bessemer machinery	5 @6c
Spring and calking	7¼@7½c
Tire	5
Sleigh shoe	5

Bessemer Steel Tire.

¾ to 1 by 3-32	4½ ℔ lb
¾ to 1 by ¾ to 5-32	4½ ℔ lb
¾ to 1 by 3-16 to ¼	4½ ℔ lb

Miscellaneous Cast Steel.

Auger and auger bit	1
Axle steel for wagons	7
Frog points and plates	8
Frog size bars	8½
Pick, hammered	10
Mattock, beveled	9
Table cutlery	7½
Trap spring steel	10
Pike and cant hook	9
Coal and granite	8½

SCRAP IRON AND OLD METAL.

DEALER'S SELLING PRICES.

	Net Tons.
No. 1 wrought scrap	$20@22
Sheet and hoop "	12@14
Cast scrap, (No. 1 heavy)	17@19
Cast Scrap (Stove Plate)	13@15

OLD METALS.

Old copper per lb	13c
No. 1 H. Brass per lb	12@13
Heavy yellow Brass do.	10@12
Light Brass per lb	7@ 9
Scrap Zinc per lb	3@4
Tea Lead per lb	3
Heavy Lead per lb	4
Oily drillings	11 50
Cast borings	11 00
Machine shop wrt turnings	$15
Axle turnings	17 @ 19
Mixt turnings	13
Burnt castings	10
Malleable iron	10 00

PIPE, WROUGHT.

Standard Wrought Iron Lap Welded Steam and Gas Pipe

Inside Diameter. Inches.	Plain, Price Per Foot.	Galvan. or Enameled Per Foot.	Outside Diameter Inches.	Weight Per Foot.
⅛	08		.40	.24
¼	08	$0 11	.54	.42
⅜	09	12	.67	.56
½	11	15	.84	.85
¾	13½	19	1.05	1.13
1	19	28	1.31	1.67
1¼	27	40	1.66	2.26
1½	33	47	1.90	2.69
2	46	64	2.37	3.66
2½	75	1 00	2.87	5.77
3	95	1 30	3.50	7.55
3½	1 25	1 70	4 00	9.05
4	1 50	2 05	4.50	10.73
4½	1 75	2 40	5.00	12 49
5	2 25	3 00	5.56	14.56
6	2 75	4 00	6.62	18.76
7	3 75	....	7.62	23.00
8	4 75	....	8.62	28.00
9	6 50	....	9 68	34.46
10	8 00	....	10.75	40.64
12	12 00	....		54.65

Discount, car load lots, 70 and 5 per cent Less than car load 67½ to 70.

COAL,

WHOLESALE.

Wholesale f.o.b. cars at Cleveland:

Carbon Hill and Monday Creek	$2 50
Massillon	2 75@2 85
Palmyra, lump	3 25
Brier Hill	3 50
Pittsburgh	3 00
Salineville	2 25
Tuscarawas	2 40
Anthracite grate	5 18
Anthracite egg	5 27
Anthracite stove	2 49
Anthracite chestnut	5 49

RETAIL.—Delivered.

Massillon Lump	$4 00
" Nut	3 75
Carbon Hill and Monday Creek, lump	3 50
Carbon Hill and Monday Creek, nut	3 25
Straitsville, lump	3 75
Straitsville, nut	3 50
Palmyra, lump	4 50

75c less on cars by car load.

Anthracite Stove and Chestnut	6 25
Egg and grate	6 00

OILS.

Pure Oils. p'kages included

Sperm, winter bleached per gal	1 33@1 35
Whale, winter bleached per gal	65@70
Straits	45@50
'A' oil for tanner's use	30
Lard oil extra W S	91@93
do No 1 do	74@77
do No 2 do	65@68
Tallow oil	72@76
Neatsfoot oil pure	95@$100
do No 1	80@85
Linseed oil, raw	57@60
do do boiled	60@63
Cotton seed oil white	62 @ 65
do do yellow	61 @ 64
West Virginia lubricating 28 deg	12c@25c
Paraffine oil winter pressed	22@25
Machinery	32
Engine	35
Miners' oil	50
Drilling oil	40
Turpentine, per gal	43

GLASS.

(Per box of 50 feet)

SINGLE THICKNESS

6x8 to 10x15	
11x14 to 15x24	8 50
16x24 to 20x28	9 75
15x34 to 24x30	10 75
26x28 to 24x36	11 50
26x36 to 26x44	13
26x46 to 30x50	14 00

DOUBLE THICKNESS	Dis 60&10
6x8 to 10x15	11 7
11x14 to 15x24	13 25
16x24 to 20x28	15 75
15x34 to 24x30	17 25
26x28 to 24x36	18 50
26x36 to 26x44	21 25

Dis 70

EVAPORATIVE TESTS OF BOILERS.

[Concluded from Page 8.]

sults. Two tests were made of each boiler, the first called the capacity test, in which the boilers were fired with full draft, and the second the economy test, in which the draft was checked so that the fires burned only about three-fourths as much coal as in the capacity test. According to the figures, two of the boilers superheated when driven fast and primed when slow, two primed when fast and superheated when slow driven, five primed more when fast than when slow driven, and one primed less, three superheated more, and two superheated less when fast than when slow driven. The Galloway boiler which was tested both with anthracite and with bituminous coal primed in both tests with anthracite, and superheated in both tests with bituminous. These results are in many cases so different from what might have been expected as to throw serious doubt on the accuracy of the tests themselves. The total range in quality of the steam was now over 18 per cent. of priming to 71 deg. of superheating. Only three of the boilers tested showed a priming of over three per cent., and the the probable error of the test itself is supposed by good authority to be equal to this percentage. This all tends to show that figures obtained from priming tests must be received with some degree of allowance.

It would be very desirable for comparing records of tests of different boilers if engineers would agree upon some uniform method of reporting results. I have had frequent occasion to study the reports of tests, in which some of the data had been left out. I give below a schedule of headings which has been found convenient in reporting tests, and the data under each heading should be filled out whenever possible:

1. Date of trial; 2. Description of boiler, including square feet of grate and heating surface; 3. Duration of test; 4. Average steam pressure; 5. Average temperature of feed; 6. Pounds of coal burned; 7. Percentage of ash and moisture in coal; 8. Pounds of combustible in coal; 9. Coal consumed per square foot of grate per hour; 10. Water evaporated, pounds; 11. Water evaporated per square foot of heating surface per hour; 12 Water evaporated, per pound of coal, actual conditions; 13. Water evaporated, per pound of coal, from and at 212 deg.; 14. Water evaporated per pound of combustible, actual conditions; 15. Water evaporated per pound of combustible, from and at 212 deg.; 16. Rated horse power; 17. Horse power developed (at 30 lbs. water per hour from 212 deg. to 70 lbs. pressure); 18. Horse power per cent. above (or below) rated capacity; 19. Temperature of flue gases, by pyrometer; 20. Force of draught, in inches of water column.

The horse power developed is obtained by taking the number of pounds of water evaporated per hour under actual conditions, reducing this by means of the steam table and formula heretofore given, or by multiplying by the factor of evaporation, to the equivalent evaporation from and at 212 deg., dividing the product by 1.034 (which is the ratio of the evaporation of 1 lb. from and at 212 deg. to the evaporation from 212 deg. to steam at 70 lbs. pressure) and 330.

After having made a test of a boiler, and having discovered that the economy of fuel is not what it should be, the next thing for the owner of the boiler or his engineer to consider is what are the causes which lead to a waste of fuel. In order for a proper consideration of the question it is essential to have a knowledge of the conditions necessary to secure economy. A few words on this subject may not here be out of place.

Briefly stated, the chief general conditions upon which economy of fuel in a steam boiler depends are, first, the complete combustion of of the coal with the smallest possible supply of air which will burn all the carbon of the coal to carbonic acid; second, the carrying into the chimney of the smallest volume of gases at the lowest possible temperature, which temperature however must not be lower than the temperature of the steam in the boiler, and third, the smallest possible escape of heat by radiation.

Complete combustion of the coal with the minimum supply of air is coincident with high temperature in the furnace. The temperature may be lowered by too great a supply of air either through the grate bars or above them, also by too small a supply, causing the coal to be only partially burned, allowing the escape of smoke and of unconsumed carburetted hydrogen and carbonic oxide gases. To secure complete combustion with a minimum supply of air two things are necessary, a good furnace and a good fireman. It is unfortunate that machinery has not yet taken the place of the severe manual labor of shovelling coal into a furnace, and at least twenty per cent. of the fuel with the best furnace and the best boiler may be wasted by a bad fireman which might be saved by a good one. A good fireman is not generally appreciated nor as well paid as he should be, for by his skill he may easily save to his employer as much money as his wages amount to.

If there is a good fireman and a good furnace, and the coal is thoroughly burned, the next place to look for waste is in the boiler itself. In the first place the setting of the boiler, its flues, and other passages of the heated gases should be so arranged that the currents of the gases will be caused to be thoroughly split up into small portions and to hug as it were the heating surfaces of the boiler, instead of being allowed to find short passages of exit to the chimney along the walls, where only one side of a current has a chance to touch the heating surface. The arrangement and position of the heating surface with reference to the position of the furnace and the direction of the currents of gas are thus of primary importance.

The thinness of heating surface is another condition of economy. It has been experimentally proved that heat will pass quicker through a thin plate of iron into water on the other side of it than through a thick one. So also the freedom from scale is a still more important condition. Some experiments have indicated that 1-16 of an inch of scale will cause a loss of 13 per cent of fuel, ¼ inch 38 per cent, and ½ inch 60 per cent. The keeping of the inside of a boiler perfectly clean is therefore of the greatest importance in order to avoid waste of fuel, as it also is to avoid danger of explosion.

The next condition of economy of fuel is the extent of heating surface. Other conditions being the same, the greater the extent of heating surface, the more heat will be absorbed from the heated gases, the lower temperature these will have when they reach the chimney, and the greater will be the economy. Other conditions being the same the smaller the heating surface, the less the boiler will cost, but the more it will waste fuel. There may be circumstances under which the interest on first cost of increased heating surface, and the value of the room occupied by it will be greater than the saving of fuel which might be made by such increase, but in ordinary practice, especially in Pittsburgh, it will be found that the saving of fuel would more than repay the extra expense of increase of heating surface.

Mr. Chas. E. Emery, C. E., in the Report of the Judges of the Centennial Exhibition, before referred to, gives a table showing the ratio of the capacity and economy to the extent of heating surface, which I have reproduced in the appendix to this paper. It is based on the highest possible rate of evaporation for the several rates of combustion, assuming the water to be evaporated from a temperature of 212 deg. into steam at atmospheric pressure, that 24 pounds of air are used to burn each pound of combustible, and that the gases escape into the chimney at 212 deg. This table shows conclusively the great loss of economy due to driving boilers too rapidly, or trying to get more than a reasonable evaporation per square foot of heating surface.

For instance: with 25 square feet of surface per horse power a horse power may be obtained with 3.02 pounds of coal, and with 9 square feet, with 3.23 pounds of coal, which indicates that to increase the heating surface from 9 square feet to 25 square feet would scarcely pay for the small saving of coal, but if only 4 square feet per horse power are used, which is not uncommon in this vicinity, the coal consumption rises to 3.77 pounds, a waste of 15 per cent. If a boiler owner will figure up the heating suaface of his boiler, and the amount of coal burued per square foot of heating surface per hour, this table will show what relative economy may be expected from such a rate of combustion per square foot of heating surface, and it will generally be found that if his boiler burns more than from 3 to 4 tenths of a pound of coal per square foot of heating surface, unless he gets his coal for almost nothing, that it will pay to put in an extra boiler, or change the one he has for a larger one. It must be remembered that the figures in the table of water evaporated per pound of combustible and coal per horse power per hour represent the best possible results, and they will rarely be reached in every-day practice.

Another condition of economy of fuel in a steam boiler is the circulation of the water within it. As the efficiency of any portion of the heating surface, or the rate of transfer of heat through it is greater, the greater the difference between the temperature of the water inside and of the heated gases outside; consequently if the circulation of the water inside is of such a nature as to continually sweep the hotter portion of the surface with fresh currents of water, it will render the heating surface more effective.

The conditions of economy, however, are all reduced to the three first mentioned, namely, proper combustion of the fuel, so as to obtain the highest temperature of the fire, the least loss of heat up the chimney and the least loss from radiation.

The principles of the proper proportioning of steam boilers are now well understood among engineers who have devoted attention to the subject. It is possible in regular practice, with a good boiler, a good furnace under it and a good fireman, to utilize 75 or 80 per cent. of the theoretrial heating power of the combustible. There is therefore but little margin for improvement in the construction of the best makes of steam boilers in order to secure any greater economy. What is needed is the application of well-known principles of economy to every-day practice. The furnace under the boiler is in need of improvement much more than the boiler itself. A furnace for burning bituminous coal without smoke and at the same time without excess of air supply, and without a steam jet, which shall be fed by machinery, or automatically by gravity, and is not dependent for its economical results upon the skill of some poorly paid fireman is among the possiblities of the future. It may be that we shall come to gas firing, using some form of gas producer which is not yet before the public. Improvements in this direction are greatly needed, and the fortunate inventor who brings them into general use will reap a rich reward.

Construction.

TITUSVILLE, Pa., is to have a new opera-house to cost $25,000.

JOHN BOCKIUS, Canton, has plans for an $8,000 tenement block, to be erected soon.

IT has been definitely decided to erect a fine new M. E. church at Jamestown, N. Y.

IT is said a large canning establishment is to be put in operation at Middlebranch, O., this summer.

PLANS for a $10,000 Children's Home have been approved by the commissioners of Summit county at Akron.

THE Leader learns that Vanderbilt is very much interested in the proposed elevated railway from the Public Square to Lake View Cemetery, this city, as it will give the Nickel Plate Railroad all the advantages of a depot on the Public Square, passengers from Cleveland for Buffalo and Eastern cities being able to make connections with this road at Lake View Cemetery.

THE Morse Bridge Co., Youngstown, we learn from the News-Register, is engaged in extending its plant and purchasing heavy machinery which will make it fully able to compete with the largest concerns in the United States. Last week they completed the setting of a large tubular boiler six feet in diameter which, with their previous boiler capacity, will give them an abundance of steam to supply the entire works. Another important addition to the works is the erection of a heavy trip hammer to be used in making eye plates which are an important part in the construction of a bridge.

TRAVELERS' REGISTER.

Lake Shore & Michigan Southern.

TRAINS GOING EAST.	Arrive. From West.	Depart. From East.
Fast N. Y. Express	*1 35 a m	*1 50 a m
N.Y.,Bo't'n & At. Ex.	*7 05 a m	*7 30 a m
Elyria Accommodation	†8 35 a m	.....
Pt.Clinton Accom'd'at'n	†11 00 a m	.....
Buffalo Accommodation	†11 00 a m	†11 15 a m
N. Y and B't'n Fast Ex.	*2 25 p m	*2 55 p m
Conneaut Accom'dation	.....	†4 50 p m
Night Express	†10 10 p m	†10 35 p m
TRAINS GOING WEST.	Arrive. From East	Depart. From west.
Fast Limited Express	*12 23 a m	*12 33 a m
Mich. Ex. via Sandusky	*2 50 a m	*3 05 a m
Chi. Ex. via Sandusky	†6 35 a m	7 00 a m
Mich. Ac. via Norwalk	.....	†6 40 a m
Conneaut Accom'dat'n	†8 40 a m	.....
Toledo Ex. via Norwalk	†1 25 p m	†3 30 p m
St. Louis Ex. via San'ky	*1 40 p m	*2 05 p m
Chi. Pac.Ex. via Nor'lk.	*7 05 p m	*7 35 p m
Pt.Clinton Accom'dat'n	.....	†5 00 p m

Sunday trains for Nottingham—Depart 0:00 a. m. and 2:15 p. m., return at 10:05 a. m. and 4:45 p. m.

Reference marks—*Daily. †Daily except Sunday. ‡Daily except Monday.

Cleveland, Columbus, Cincinnati & Indianapolis.

ARRIVALS.

No. 2 Col. & Cin. & Ind'polis Ex. ....*7 10 A.M
No. 8 C. T.V. & W. & Clev. Accom..10 30
No. 12 St. Louis & New York Exp..*3 00 P.M
No 6 Indianapolis & Columbus Exp10 20
No. 4 Columbus & Cincinnati Exp..*8 40
No. 10 Wheeling Express..... 7 15

DEPARTURES.

No. 1 Cincinnati & Columbus Exp..*8 00 A.M
No. 11 Cleve, Indianap.&Wheel'g Ex 7 10
No. 3 Special St. Louis & Cin. Ex..*1 55 P.M
No. 5 Night Express,.....*7 25
No. 7 C.T.V. & W. & Col. Accom 4 00

**This train runs daily to Indianapolis and St. Louis, and daily, except Sunday, to Cincinnati.

Cleveland, Tuscarawas Valley & Wheeling.

ARRIVALS.

Wheeling & Cleveland Express.....7 15 P.M
Uhrichsville Express..... .....10 15 A.M

DEPARTURES.

Wheeling & Cleveland Express.....7 10 A.M
Uhrichsville Express ..... 4 00 P.M

New York, Pennsylvania & Ohio.

ARRIVALS.	a.m.	a.m.	p.m.	p.m.
Through from East	6 50	.....	.....	*7 00
N.Y. P. & O. (Mah'g)	10 55	.....	2 00	*7 00
Pittsburgh Express	.....	.....	2 00	*7 00
Pitts'g& Yo'gs'tn Ac.	10 55	.....	.....	10 15
DEPARTURES.	a.m.	a.m.	p.m.	p.m.
Through E'tern Train	*7 10	.....	.....	10 45
N. Y. P. & O. (Mah'g)	.....	.....	.....	4 25
Yo'gs'tn & Pitts'g Ac.	.....	11 00	.....	.....
Pittsburgh Express	.....	*7 10	*2 30	.....

Cleveland & Pittsburgh.

	ARRIVE.	DEPART
Pittsburg & Wheeling	2 30 P.M	8 25 A.M
Express	7 30	2 00 P.M
Alliance Accommodation	10 10 A.M	3 45
Ravenna Accommodation	8 37	5 30
Night Express	6 25 A.M	†11 40 P.M
Newberg Accom'dation	12 10 P.M	11 00 A.M
Newberg Accom'dation	1 50 P.M	12 30 P.M

† Night Express runs daily, except Saturday, by way of Wellsville, and on Saturday by way of Alliance.

Valley Railway.

	ARRIVE.	DEPART
Wheeling Junction	10 15 A.M	8 30 A.M
Canton	1 30 P.M	5 00 P.M
Wheeling Junction	6 15 P.M	3 20 P.M

Special trains leave on Sunday at 8.25 A. M. and 4.20 P.M., arriving at Cleveland at 1005 A. M. and P. M. 6.25

Depot foot of South Water Street.

Connotton Valley Railway.

	ARRIVE.	DEPART
Passenger	8 00 a. m.	8 10 a. m.
Passenger	10 20 a. m.	2 00 p. m.
Passenger	6 35 p. m.	4 25 p.m.

Depot corner Commercial and Fifth Streets

Cleveland, Akron & Columbus Railroad,

Cleveland, Akron & Columbus Railroad, running over Cleveland & Pittsburgh Railroad to Hudson, for Akron, Columbus, etc.

	ARRIVE.	DEPART.
Mail	2 30 P.M	8 25 A.M
Express	7 30	2 00 P.M
Accommodation	10 10 A.M	3 45 P.M

"The Nickel Plate."

	ARPIVE.	DEPART
Local Passenger	10 00 P.M	3 48 P.M
Local Passenger	9 18 A.M	6 55 A.M
Conneaut Accom'dation	9 05 A.M	4 30 P.M

TIME TABLE.
CLEVELAND & PITTSBURGH
RAILROAD.

On and after Sunday, January 21st, 1883, trains depart from and arrive at Union Station, Cleveland, (city time) as follows:

DEPART.

For the East--8:20 A.M.; 1:55 P.M., 11:35 P.M
For Alliance--3:40 P.M.
For Ravenna--5:25 P.M.
For Newburgh--10:55 A.M; 12:95 P.M.
On Sunday for the East, at 11:35 P.M.

Train leaving for the East (week days) at 1:55 P.M. has sleeping car through to Philadelphia and New York.

Train leaving for the East every night at 11:35 has sleeping car to Pittsburgh.

On Saturday night the train for the East leaving Cleveland at 11:35 runs from Alliance to Pittsburgh via P F.W. & C Railway.

ARRIVE--(Week Days.)

From the East--6:20 A.M.; 2:25 P.M.; 7:25 P.M
From Alliance--10:05 A.M.
From Ravenna--8:32 A.M.
From Newburgh--12:05 P.M.; 1:45 P.M.

Time tables, rates of fare, through tickets and further information can be obtained from M. G. Carrel, agent, Union Station, or C. L. Douglass, No. 212 Bank street.

WM. A. BALDWIN, Manager, Pittsburgh, Pa.
E. A. FORD, Gen. Pass. Agt.

Blue Grass Route of Ohio
TIME TABLE.
The Cleveland, Mt. Vernon and Delaware RAILROAD.

GEO. D. WALKER, RECEIVER.

SOUTH-BOUND TRAINS.

	Mail.	Expr'ss.	Acc'm	Acc'm
Leave.				
Cleveland	8 25 am	2 00 pm	3 45pm	.....
Hudson	9 40	3 10	5 00	.....
Cuyahoga F's.	9 57	3 27	5 20	.....
Akron	10 12	3 42	5 43	.....
Clinton	10 42	4 14	6 17	.....
Warwick	10 47	4 19	6 23	.....
Orrville	11 14	4 45	6 50	.....
Fredricksburg	11 45	5 17	7 23	.....
*Holmesville	11 55	5 27	7 33	.....
Millersburg	12 08	5 40	7 45	5 35
*Killbuck	12 22 pm	5 54	.....	5 49
Gann	1 00	6 53 S	.....	6 49 B
Danville	1 11	7 04	.....	7 01
Gambier	1 31	7 24	.....	7 21
Mt. Vernon	1 45	7 38	.....	7 34
*Mt. Liberty	2 07	8 00	.....	7 53
Centerburg	2 19	8 12	.....	8 05
*Condit	2 33	8 26	.....	8 19
*Sunbury	2 43	8 36	.....	8 29
Westerville	2 05	8 59	.....	8 52
Columbus	3 30	9 25	.....	9 20
Cincinnati	8 00	.....	.....	.....

NORTH-BOUND TRAINS

STATIONS.	Expr'ss.	Mail.	Acc'm	Acc'm
Leave				
Cincinnati	.....	8 00 am	.....	.....
Columbus	7 20 am	12 25 pm	.....	5 15 pm
Westerville	7 45	12 50	.....	5 43
*Sunbury	8 08	1 11	.....	6 06
*Condit	8 19	1 21	.....	6 17
Centerburg	8 33	1 35	.....	6 31
*Mt. Liberty	8 45	1 47	.....	6 43
Mt. Vernon	9 11	2 12	.....	7 08
Gambier	9 24	2 25	.....	7 24
Danville	9 44	2 45	.....	7 44
Gann	9 57	2 57	.....	7 56
*Killbuck	10 35	3 35	.....	8 32
Millersburg	10 51	3 50	5 45am	8 45
*Holmesv'e	11 04	4 03	5 58	.....
Fredricksb'g	11 15	4 12	6 08	.....
Orrville	11 50	4 45	7 10 B	.....
Warwick	12 14	5 10	7 37	.....
Clinton	12 19	5 15	7 46	.....
Akron	12 50 pm	5 43	8 20	.....
C'yahoga F's	1 02	6 01	8 33	.....
Hudson	1 20	6 20	8 53	.....
Ar. Clevel'd	2 30	7 30	10 10	.....

* Stop on signal. B Breakfast. S Supper.
N. MONSARRAT, Gen'l Supt. Akron, O
E. T. AFFLECK, General Passenger Ag't, Columbus, O.

Cleveland to New York,
VIA THE
NEW YORK, PENNSYLVANIA AND OHIO RAILROAD.

[Formerly Atlantic & Great Western Railroad]

For New York, Boston and the East. The shortest and quickest route to Pittsburgh, Washington, Baltimore and the Southeast.

Until further notice trains will leave the new Central Depot, South Water Street and Viaduct, as follows:

7:10A.M. LIGHTNINGEXPRESS (daily) sleepingand hotel coaches from Leavittsburg. 8:55 a.m. To New York, Albany and Boston without change. Parlor car, Cleveland to Salamanca. Arrives at Meadville 11:20 a.m., (dinner); Franklin, 12:33 p.m.; Oil City, 1:00 p.m.; Corry, 1:00 p.m.; Jamestown, (Lake Chatauqua) 1:57 p. m.; Buffalo, 6:15 p. m.; Rochester, 8:30 p.m.; Hornellsville, 6:40 p. m., (supper); Corning, 8:25 p.m.; Elmira, 8:57 p.m.; Binghampton, 10:58 p.m.; Albany, 6:00 a.m.; Boston, 2:45 p.m.; arriving at New York, 6:50 a.m.

11:05 P.M. NIGHT EXPRESS, (daily except Sunday), Sleeping Coach from Leavittsburg to New York without change. Arrives at Youngstown, 1:45 a.m.; Pittsburgh, 6:15 a. m.; Washington 9:15 a. m.; Baltimore 10:34 p. m.; Meadville, 3:50 a. m.; Corry, 5:20 a.m.; Jamestown, 6:22 a.m.; Buffalo, 9:45 a. m.; Rochester, 1:10 p. m.; Hornellsvillle 1:20 a. m.; Corning, 12:53 p. m.; Elmira 1:21 p. m.; Binghampton, 2:50 p.m.; New York 9:25 p.m.

2:30 P.M. PITTSBURGH EXPRESS, daily, through without change. Parlor Car, Cleveland to Pittsburgh, arrives at Youngstown, 5:00 p.m.; Pittsburgh, 7:48 p.m.; Washington, 7:30 a.m.; Baltimore, 8:19 a.m.; via Sharon to Meadville, arriving 7:35 p. m.

4:25 P.M. MAHONING ACCOMMODATION, stopping at all way stations. Arrives at Youngstown, 7:25 p.m; Sharon, 8:30 p.m; Sharpsville 8:40 p. m; connects at Leavittsburg with train No. 20 for Meadville and intermediate points, arrives at Meadville, 11:05 p.m. Pittsburgh, 10:48 p. m.

7:10 A.M. PITTSBURGH EXPRESS, —(daily) through without change. Arrives at Youngstown, 9:50 a.m.; Sharon, 10:55 a.m.; Sharpsville, 11:05 a.m.; Pittsburgh, 12:45 p.m. Returning, leave Pittsburgh, 4:48 a.m., 8:33 a.m., and 1:13 p. m. and 4:20 p.m.

11:00 A.M. YOUNGSTOWN& PITTSBURGH Accommodation, stopping at all Way Stations, arriving at Youngstown 1:50 p.m.; Pittsburgh, 6:10 p.m. Trains arrive at Cleveland, 6:50 a.m., 7:00 p. m., 10:55 a. m 2:00 p.m., and 10:15 p.m

☞ This is the only route by which passengers can reach Corry, Elmira, Binghampton, New York City, and intermediate points WITHOUT CHANGE. No change to Boston and New England cities.

Baggage Checked Through to All Points East

☞ Through Tickets and information regarding the route can be obtained at the Union Ticket Office, corner Bank and Superior streets; at office 131 Bank street, and at new Depot of New York, Pennsylvania and Ohio Railway, South Water street and Viaduct, Cleveland.

A. E. CLARK, Gen. Pass'r. Agt., Cleveland, Ohio.
M. L. FOUTS, Pass. Agt., 131 Bank st., Cleveland.
J. M. FERRIS, Gen. Man'gr, Cleveland

THE NICKEL PLATE.

New York, Chicago & St. Louis Railroad.

The passenger equipment of this new trunk line is all new and is supplied with the latest appliances necessary to safe, speedy and comfortable travel.

Following is the time in effect January 21, 1883, and until further notice:

GOING EAST.

	Local Pass'n'gr	Local Pass'ngr.	Con'eaut Accom.
Lv. Chicago	8 10 am	.....	.....
Ar. Valparaiso	9 57	.....	.....
" Ft. Wayne	1 30 pm	.....	.....
" New Haven	2 05	.....	.....
" West Leipsic	4 09	.....	.....
" Arcadia	5 10	.....	.....
" Fostoria	5 25	.....	.....
" Gr. Springs	6 12	.....	.....
" Bellevue	6 40	.....	.....
Lv Bellevue	6 50	7 30 am	.....
Ar Cleveland	9 20 pm	10 00	.....
Lv Cleveland	.....	10 05	4 30 pm
Ar Painesville	.....	11 11	5 45
" Ashtabula	.....	12 03 pm	6 37
" Conneaut	.....	12 30	7 05
" Erie	.....	1 34	.....
" Dunkirk	.....	3 15	.....
" Buffalo	.....	5 00	.....

GOING WEST.

	Local Passn'gr.	Local Pass'ngr.	Con'eaut Accom.
Lv Buffalo	8 00 am	.....	.....
Ar Dunkirk	9 45	.....	.....
" Erie	11 31	.....	Leave.
" Conneaut	12 35 pm	.....	6 30 am
" Ashtabul	1 07	.....	7 00
" Painesville	2 00	.....	7 55
" Cleveland	3 13	.....	9 10
Lv Cleveland	3 18	7 00 am	.....
Ar Bellevue	5 45	9	.....
Lv Bellevue	.....	9	.....
Ar Gr. Springs	.....	9	.....
" Fostoria	.....	10	.....
" Arcadia	.....	10	.....
" West Leipsic	.....	11 58 p	.....
" New Haven	.....	2 05	.....
" Ft Wayne	.....	2 20	.....
" Valparaiso	.....	6 25	.....
" Chicago	.....	8 17	.....

Trains run by Columbus time, which is twenty minutes later than Chicago, five minutes earlier than Cleveland, and sixtenn minutes earlier than Buffalo time.

For rates or information, call on nearest Agent of the Company or address

HENRY MONETT, Gen'l Passenger Agent,
Hoyt Block, cor. St. Clair and Bank streets,
LEWIS WILLIAMS, Cleveland, O.
General Manager.

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Cleveland, Columbus, Cincinnati & Indianapolis Railway.

The Great Central Trunk Route to the Ohio and Mississippi Rivers.

Three Trains Week Days,
TWO TRAINS SUNDAY.

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Columbus, Cincinnati, Indianapolis, Terre Haute and St. Louis

Without Change.

☞ This is the only line making Direct Connection with all the principal Trunk Lines of the East for all Southern, Southwestern and Western points, either by way of Cincinnati, Indianapolis or St. Louis for all railway towns in Missouri, Arkansas, Texas, Kansas, Nebraska, Colorado, New Mexico, Old Mexico and the Pacific Coast.

Equipment New and Comprising all Modern Improvements.

The Best Roadbed and Safest Road in the West.

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O. B. Skinner, Traffic Manager.
A. J. Smith, Gen'l Pass. Agent, CLEVELAND, O.

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HAVING recently added new tools I am better prepared to contract for the manufacture of specialties, such as Gasoline or Oil Burners, Torches, Cutting and Threading Iron or Brass Pipe, Bolts, &c., by automatic machinery. Making special Taps, Reamers and Gears; Turret Lathes, Speed Lathes, Slide Rests. Sole manufacturer of Culver's Patent Automatic Cast Steel Bolt Cutter Head. Correspondence solicited.

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16-inch screw-cutting lathe, $200, second hand.
18-inch " 250, new.
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Power Bolt cutter, ¾ to 1 in. 100, "
Bolt header for blacksmiths, 25, "
6 drill presses, ...$25 to 200, "
4 h. p. engine and boiler, 80, second hand.
5 " " " 160, "
8 " " " 275, "
10 " " " 300, "
12 " " " 350, "
12 " " complete, 175, "
15 " " " 185, "
20 " " " 225, "
25 " " " 300, new.

Huron grindstone, mounted on frame, with pulley for power, $10.

Blower, cost $18, price $9, exhaust blower, $4.50.

Second-hand planer, $225; new iron planers, best in use, $675, and upwards.

Boilers, 10, 20, 25, 30, 35, and 50 h. p.

500 pulleys, shafting and hangers to match.

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Second-Hand Machinery.

On hand, ready for immediate delivery, viz.:

One Iron Planer, to plane 24 feet long, 62 in. x 62 in. square. It is powerfully geared, heavy and in good order.

One Planer, to plane 15 feet long, 51 in. wide. Very heavy and good tool.

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One Engine Lathe, will take 14 feet between centers, and swing 53 in. over ways, has hollow spindle, and is adapted for both turning and boring, with countershafts. Complete.

One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriages. It has internal gear, and cross feed, with countershaft. All complete.

One 3 ft. bed, 9 in. swing Screw Cutting Foot Lathe.

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One Slotting Machine, 12 in. stroke, slots to the centre of 46 in. Adjustable table and universal feed motion.

One ditto, 12 in. stroke. Very good machine.

One Combined Power Punch and Shears, to punch ⅝ and ¾, and shear ½ in. iron.

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Three heavy Upright Drills, to drill to center of 36 and 40 inches.

Three No. 2 Pratt & Whitney Milling Machines. Very good.

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One second-hand Three Spindle Drill, Pratt & Whitney, to drill holes ⅜ to ¾ inch diameter, steel spindles 1-16 inch diameter. Countershaft complete.

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One No. 3 Power Press, double action, for small work. In very good order. E. Brown, N. Y., maker.

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One Combined foot power Circular Saw, with gauge complete. New.

Four Single Acting Power Presses, same as above.

Ninety Small Foot Presses adapted for button making or any kind of light work. Will sell these very low.

One small Power Press.

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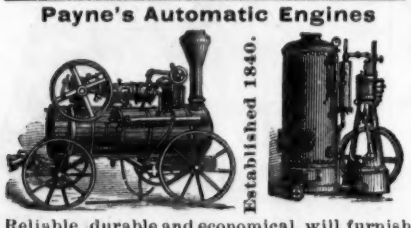

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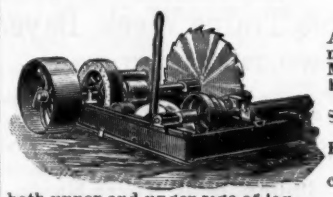

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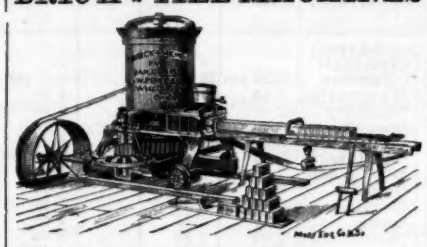

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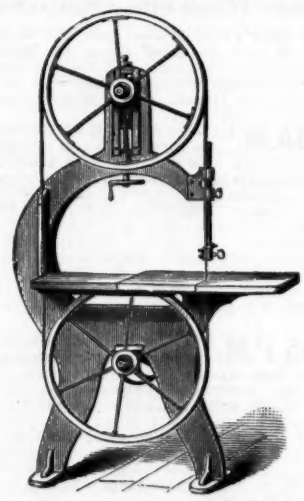

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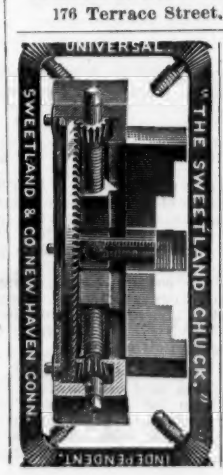

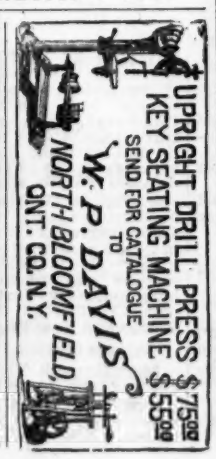

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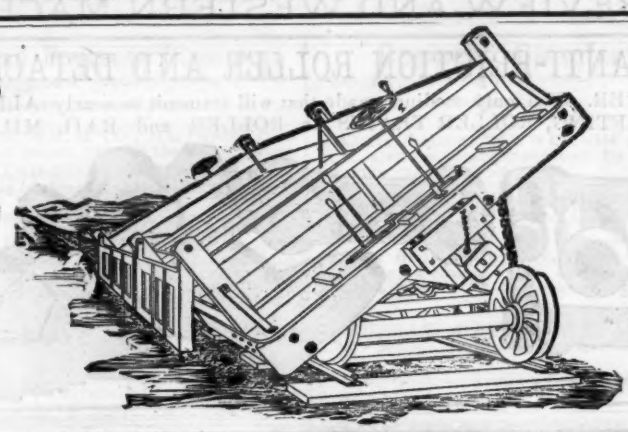
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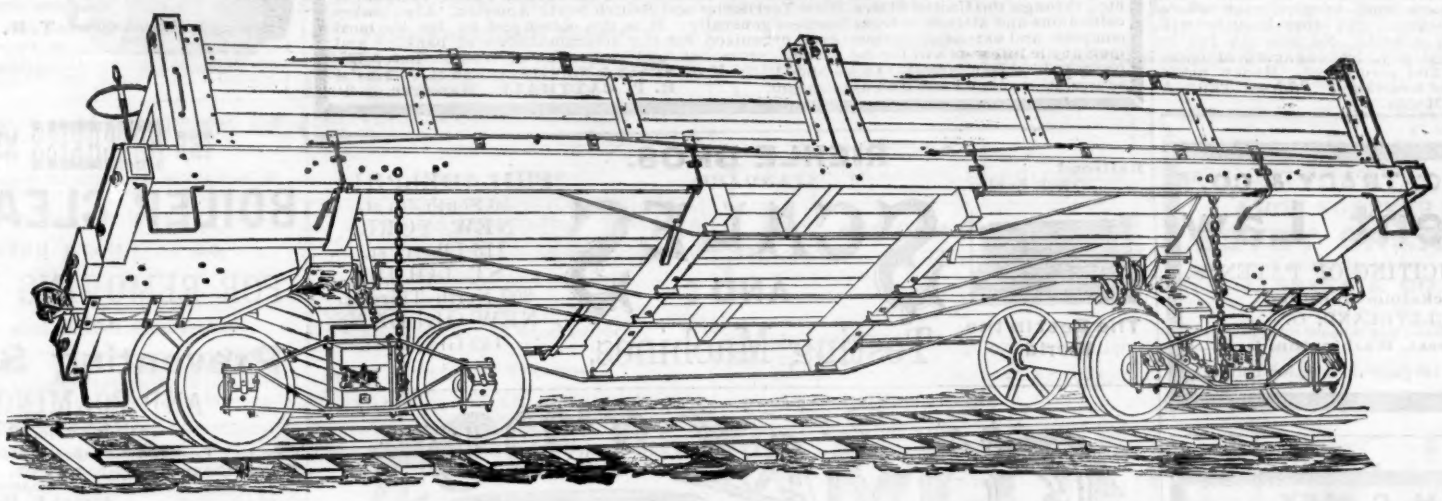
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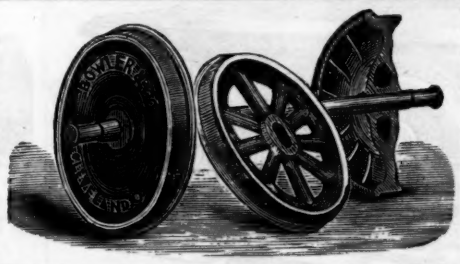

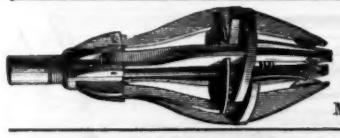

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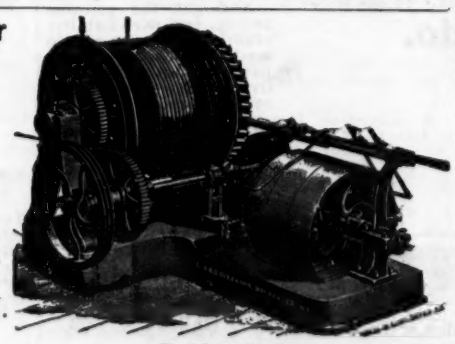
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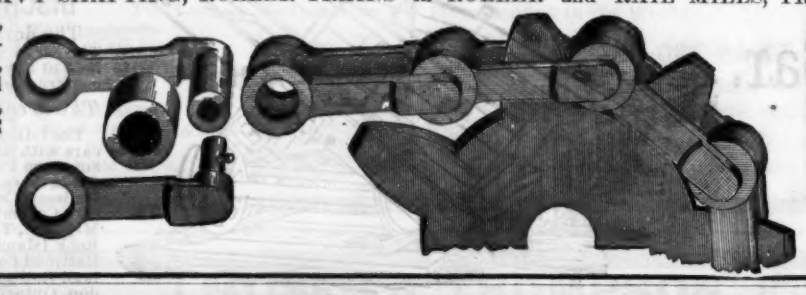

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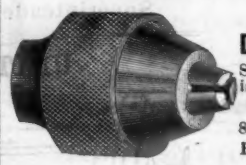

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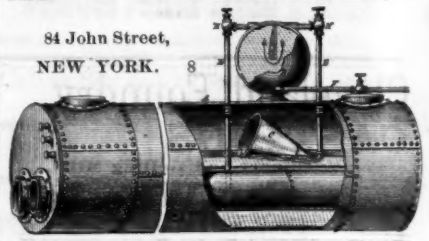

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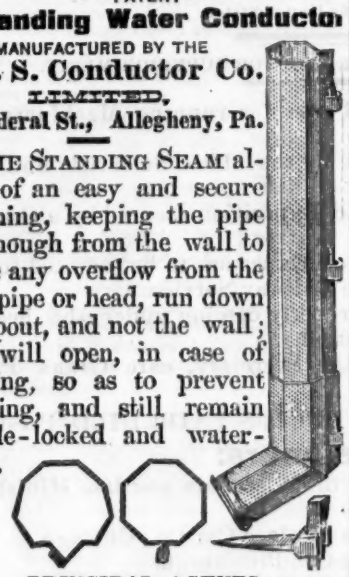

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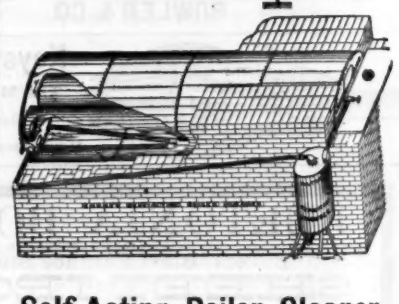

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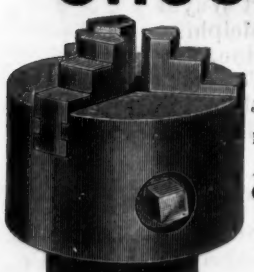

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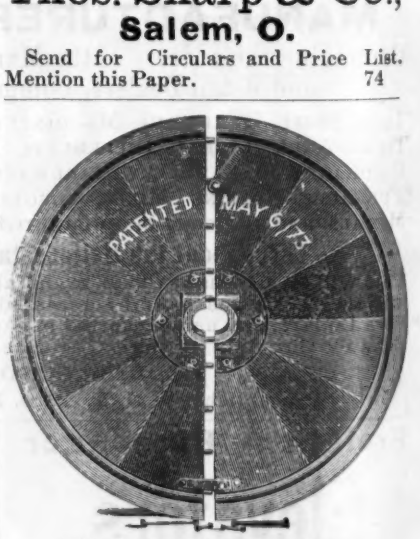

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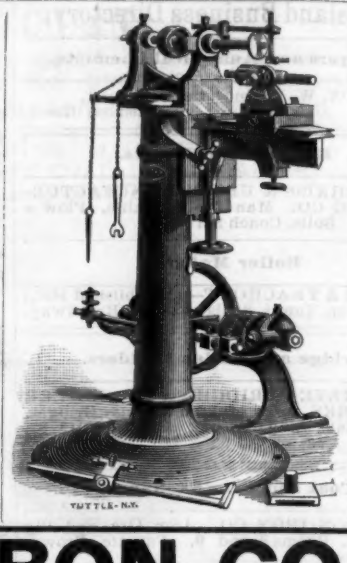

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